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PROCEEDINGS OF THE

ANNUAL CONVENTION
OCT. 15-17, 1907

Seventeenth Annual Convention

OF THE

ASSOCIATION OF
RAILWAY SUPERINTENDENTS OF
BRIDGES AND BUILDINGS

HELD IN

MILWAUKEE, WIS.

OCTOBER 15, 16 AND 17, 1907

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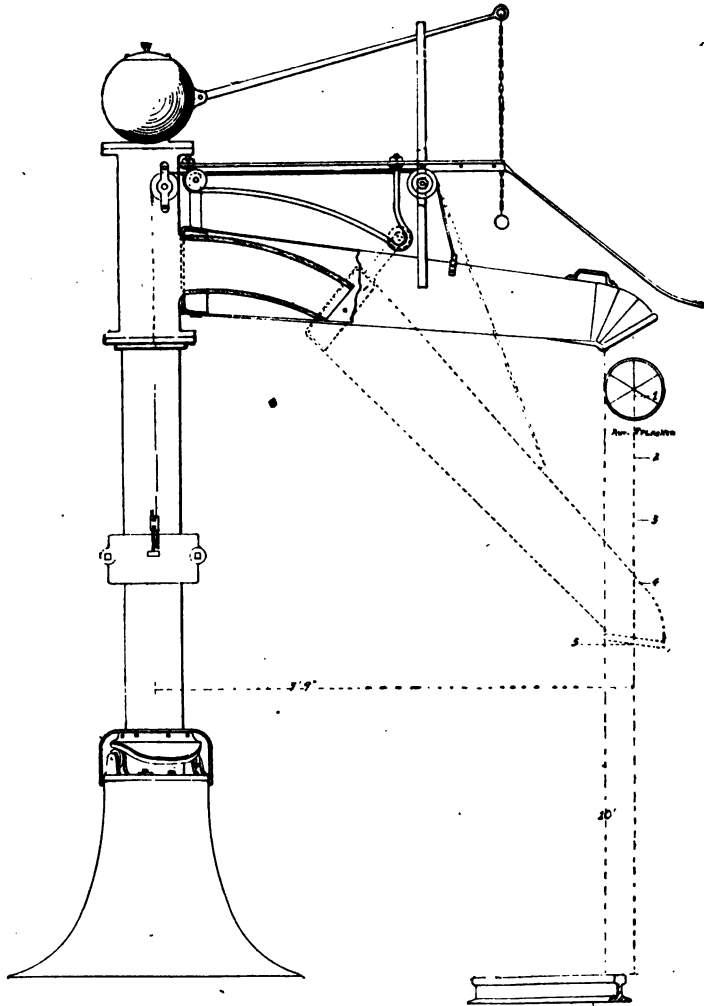
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Proceedings of the Seventeenth Annual Convention
OF THE
Association of Railway Superintendents
of Bridges and Buildings

HELD IN MILWAUKEE, WIS., OCTOBER 15, 16 AND 17, 1907

MORNING SESSION.

TUESDAY, October 15, 1907.

The seventeenth annual convention was called to order at 10.30 o'clock a. m., by President J. H. Markley in the assembly room of the Republican House, at Milwaukee, Wis., Tuesday, October 15, 1907.

President.—Ladies and Gentlemen: With but three or four exceptions, this Association has opened its sessions with prayer and heretofore this service has always been rendered by Mr. Joseph H. Cummin; now that he has retired, I am glad to say, we still possess members who can serve us in this as well as in other capacities, and I will therefore call on Mr. J. N. Penwell to offer prayer this morning.

Prayer was then offered by Mr. Penwell.

President.—The next on the program is the address of welcome. When I received the program from the committee naming the one who was to make the address, I felt that I was somewhat acquainted with the gentleman, having read more or less about him in the magazines; I was satisfied that the committee had selected the right one in the "bright spot." I have the pleasure to introduce to you this morning one who has done more than any one else towards advertising this bright spot; one who has attracted

the attention of the entire country and one who has shown what a young man can do by pluck, perseverance and progressiveness, supplemented by hard work and untiring energy; one who is every inch a man, although called the "Boy Mayor of Milwaukee." It gives me great pleasure to introduce the Hon. Sherbern M. Becker, who will now welcome you to this city.

Mr. Becker.—Mr. President, Members of the Association of Railway Superintendents of Bridges and Buildings and Ladies: It gives me great pleasure as chief executive of this city to welcome you to Milwaukee; speaking in behalf of our citizens I will say that each and every one of them welcome visitors here at all times. I am here also as a private citizen to give myself the pleasure of meeting a company of representative men—men engaged in a business which holds such a prominent and vital place in the commercial life of our nation. I hope that you will call upon our business men; you will find that they are courteous and ever ready to do what they can to make their guests' visit to Milwaukee as interesting and as enjoyable as possible.

I cannot talk to you today about your business, obviously because I know so little about it, but I can talk about Milwaukee and am ever ready to speak its praises and to tell of its achievements, its hopes and its future. Milwaukee is known throughout the United States as a great convention center and it has gained this reputation not only because of her situation upon beautiful Lake Michigan and her facilities for entertaining visitors, but because of the hospitality shown to strangers within her gates. We have beautiful drives, beautiful parks to visit and many public buildings that are well worth seeing. The city's gates are unlocked. There used to be a custom in Milwaukee of presenting a key to the different conventions that came here, but, my friends, since I have been mayor of Milwaukee a key is no longer necessary; the city is wide open at all times to guests who come here to attend gatherings.

I hope you will avail yourselves of the opportunity of going about Milwaukee, of visiting our public parks, that you will call on our business men and feel perfectly at home, just as much so as if you were citizens of Milwaukee, so that when you go back to your own beautiful cities you will have a good word to say about Wisconsin's metropolis.

Milwaukee has a population within its limits according to the latest census of over 352,000 souls. It is generally and erroneously supposed that Milwaukee's chief industry is the manufacture of lager beer. I have no desire to belittle this great industry, but I do wish to correct a wrong impression, not because I believe that the manufacture of beer has not contributed largely to our credit, but because it is a fact that we have a yearly production of \$97,500,000 in iron, steel and machinery industry, employing over 10,000 men, while the output of the breweries aggregates about \$26,000,000 and employs but 4,400 men. In other words iron, steel and machinery lead in our output and beer comes second. Figures gathered by our statisticians and published on the first day of January of this year show that the 3,468 manufacturing establishments in the city of Milwaukee pay out in wages over \$56,000,000 a year; the amount of capital invested is over \$209,000,000 and the output of this great force of wealth, muscle and brain makes the magnificent aggregate of over \$315,000,000.

My friends, I hope that you will not hesitate to call upon me at the city hall; to any who are interested in municipal subjects, I shall be glad to give information regarding the transaction of business of the municipality.

I am here today to greet you and welcome you to our city. I want you all to have a good time. Mr. Watrous, who is going to give a lecture here tonight, showing some views of our city, asked me if it would be possible to take the members of this Convention out on the fire-boat. I told him it would be, and I should be very happy to take a delegation of fifty, or possibly seventy-five, on the fire-boat

and to take you through some of our rivers, to show you the new Bascule bridges and railroad bridges in which I am sure you are interested. To the ladies who do not care to spend all their time in the business sessions, I wish to say that Milwaukee has a great many fine theatres and we have a number of fine attractions here this week. If it is possible for me to be of any further service to the Convention, I hope you will make your wants known. I sincerely trust that you will enjoy yourselves and that your visit to Milwaukee will be so satisfactory that I shall have the honor of entertaining you again. May the success of your Association continue. I thank you one and all for your kind attention. (Applause.)

President.—Mr. Becker, when I thank you in behalf of the members of this Association for your address giving to us such a hearty welcome to this “bright spot,” it means just as much as though I had talked for one hour. Again I thank you for the honor of your presence and wish for you and your city a prosperous future.

According to our program, Mr. W. A. Gardner, the first vice-president of the Chicago & Northwestern Railway Company, was to make the opening address; in his stead it gives me pleasure to introduce to you this morning one who has started at the bottom of the ladder; who has come up through the engineering and bridge and building departments, and who is able to speak from a practical standpoint, Mr. R. H. Aishton, the general manager of the Chicago & Northwestern Railway Company.

Mr. Aishton.—Mr. President, Ladies and Gentlemen: It is a matter of great regret to me that Mr. Gardner could not be here as per program. I think you can imagine my feelings on that score. On the other hand, I am very glad to be honored with the opportunity of speaking to you this morning. A few months ago one of your members came to me and suggested that if I would come up to Milwaukee on the occasion of the Seventeenth Annual Convention and meet some of the boys and shake their hands that it would

be a nice thing. Of course knowing Milwaukee's reputation for hospitality no Chicago man could possibly "turn down" a proposition of that kind and I accepted; the next thing that happened the same gentleman informed me that I would be expected to say a few words of greeting (laughter), and you can imagine my surprise on arriving here today to see by your program—that I am down for an address. Now I never delivered an address in my life. I might address you on the same subject his honor the mayor has, in extending to you a cordial welcome to Milwaukee, knowing Milwaukee and its reputation for hospitality as I do, or I might address you on the question of Federal vs. State Control of Railroads, which is an interesting subject, but the papers are full of it. I might possibly better talk to you on the noble art of pugilism, in its latest application to railroad managements (laughter), but I always believe a shoemaker should stick to his last, and therefore all there is left to me to do is to talk shop instead of giving you an address; I will impose on you a short shop talk this morning.

In the first place, what does this Association stand for? I have never seen your motto, but my understanding of it is, that the Association stands for the development, in the highest degree, of the efficiency of its members, of materials and of methods. When you come to consider what has been accomplished during its life of seventeen years, you have only to look around a Convention like this and read the report of the committees to know what has been done for the members of this Association. So far as the development of materials and methods are concerned, great things have been accomplished in the history of this Association. In looking back seventeen years and noting the requirements of the railroad service at that time and comparing same with today you will see enormous progress has been required and has been made. Today what the railroads are seeking for is the greatest efficiency and the greatest economy, not in the first cost, but in the ultimate cost and service per-

formed. You have done great things in that respect and what you have done in the past, in adopting better methods or in developing better materials, as I look at it, has been accomplished by the education of your own members and within a comparatively small circle, and whether the matter of education and information has gotten outside your own membership or fulfilled its ultimate destiny you are better prepared to say than I.

It has seemed to me that in the future you should go a step further to secure the full measure of benefit to the railroad companies and to the community at large. There are a great many railroad managers,—I may say a large majority of railroad managers,—today that do study the improved methods and recommendations of this Association. Take my own case on the Northwestern road: I know we have, and that same thing pertains to a great many roads. The work of this Association is receiving careful attention and we are interested every year in the recommendations for improved methods that take place. I notice on your program this year that you have three matters of great importance, and which are being watched by us carefully. This matter of smoke jacks for engine houses. I believe the recommendation of this Association is the adoption of a smoke jack of different material than the old cast iron jacks. I see you are going to have a paper on that subject. I hope you will arrive at some conclusion, and that that conclusion will not only be published in your reports, which go to a limited number, but that it will go out in some further form, that will reach every railroad management in the country, so that your recommendations may become standard. I do not know how this is to be accomplished, but it is worthy of your most serious consideration. Another subject of great interest is the subject of a combination fastening and lock for rolling and sliding doors on freight houses, and if you can determine on some kind of an arrangement that will be satisfactory and safe, you will be conferring a great benefit to the railroad companies, and

not only that, but a great benefit to mankind as a whole, through elimination of the numerous personal injuries resulting from present forms and practices.

The other matter,—of protecting steel railroad bridges. I never realized the importance of that until within the last thirty days. I had occasion to walk for several miles along the track where we handle a large number of refrigerator car meat trains, and on that walk I learned more about the injury produced by salt brine drippings to the rails, angle bars, bolts, spikes, switches and bridges than I ever dreamed of. If you can find some way to prevent that, you have done something that ought not to end in the report of your Convention, ought not to end in the appearance of the paper in the technical journals, but should be forced home to every railroad officer in this country. This is the only thought I have in connection with your work. I have read the Proceedings of your conventions for years and have adopted on my own judgment some things that you have recommended, but it seems to me your work is of such great value, not only to yourselves, but to the railroads as a whole, that in some manner, either through the American Railway Association or some kindred association, your recommendations should go to the railroad managements in general as recommended practice. This is an age of specialization and who is better qualified than your membership to express opinion and recommendation on your particular specialty. After such recommendation on your part, what could give more weight to the various managements than the endorsement and recommendations of such an organization as the American Railway Association or the American Railway Engineering and Maintenance of Way Association, and it is in my opinion that it is through your close association with the latter association that your committee reports will receive their final analysis, criticism or approval. This latter once secured, there is not much question as to their adoption as standard in the same way that the code of train rules, car service rules and all the

other various operating matters have through the recommendation and endorsement of the American Railway Association become standard on the majority of the railway mileage in this country today.

I do not know that I have anything further to say, except that I am pleased to see such a large attendance at this Convention. The work your committees have done is wonderful and the attendance at these meetings cannot but be of the greatest encouragement to them in perfecting their reports. I am pleased also to see the ladies here, as I have great appreciation of the influence of the ladies in railway work. I used to be an assistant superintendent of bridges and buildings out in Iowa and was the assistant of a gentleman I see in front of me here this morning, Mr. W. D. Walden. I never knew why I was made his assistant, whether it was because I could letter a blue print a little better than the rest of the office force or not, and it has always been one of my life problems, as I never had any qualification for the job, but I was going to tell you how I appreciate the value of the ladies in work of this kind. You know we lived in a little town out in Iowa where the ladies used to give these four o'clock teas and make ear muffs for the savages out in Africa (laughter), and one of the ladies said, "Oh! Mrs. Aishton, I do wish I was fixed the way you are, to have a carpenter right in the house, so that when there is a nail to drive or a door to hang he could do it." Mrs. Aishton replied "that if there was any nails to drive that her husband couldn't hit a nail on the head in seven years, and if there were any driving of nails to do, she always had to do it herself." I have always thought ever since then the ladies were really the ones, when you come to any question, who always hit the nail on the head. (Laughter). Mr. President, I thank you for your kind attention. (Applause.)

Mr. President.—Mr. Aishton is not expecting me to make a very lengthy reply. He at one time being connected with the bridge and building department, knows just what knotty problems we are sometimes called upon to untie. We are

all specialists and devote our entire time to the treatment of our cases, consequently, there are but very few of us who have the gift of building speeches. I think I am right, when I compare the members of this Association to two of the greatest warriors this country ever produced, Washington and Grant; they were great commanders, but no speechmakers. Our specialist in this line who will make a further reply will need no introduction. Mr. Rettinghouse, I will ask you to respond to Mr. Aishton.

Mr. Rettinghouse.—Mr. Aishton, when our president, during your very able address was casting his weather eye about in search of a victim to reply to you and when it finally rested upon me, I at once became very apprehensive and aware of my shortcomings in that direction. In short, I am not a speaker, not even an orator. (Laughter.) I find consolation, however, in my dilemma in the remembrance of an old legend, which was told me in my school days. As the legend, or the story goes (for a story it is after all), the gods during the creation of mankind found during the distribution of the various parts making up a human being, that there was not enough brain power to go around and they made up the deficiency with a fluent tongue. It is, of course, understood that general managers and city mayors are excepted because there were no such officials in those days. You, sir, are perhaps in a better position than many of your colleagues to judge the aims and purposes of this association and the advantages and profits gained by its members and their employing companies from the discussions of reports on subjects vitally pertaining to the bridges and building work of railroads. I say that you are better enabled to judge all this owing to the fact that at one time you yourself, as stated in your address, was an assistant superintendent of bridges and buildings, and I understand from our old friend, Mr. Walden, that you served in that capacity with entire credit and proved yourself to be an able assistant. It is gratifying to know that this fact has left a warm spot in your heart

for these bridge men, and I know from personal observation that you have not only endeavored to induce your subordinates to attend these conventions, but by directions within your power have made it possible for them to do so. All of us know the strenuous duties of your position and what sacrifice it means on your part to take enough of your time to be with us today, and in behalf of this Association I want to extend our heartfelt thanks for the address which you have given us, as well as for championing our cause in general, and I thank you for the general interest you have always taken in the work of this Association. I have been a member of this Association for a number of years and the task of replying to this address has always been vested in one who was singularly gifted in that direction and who stands high in his profession, as well as in the esteem of all members of this Association. I refer to Mr. J. H. Cummin until recently with the Long Island Railroad, or "Joe Cummin," as he is better known among us, but Joe is not "cummin" this year (laughter), and so if I, as his humble successor in that capacity, have succeeded in expressing the gratitude of this Association for your kindness shown, I am sure it will be appreciated by all of us and I myself will feel as well repaid for the effort which I have made in the speechmaking line.

We assemble each year not only for the purpose of deliberating upon and engaging in earnest discussions which come before us, but we consider this as a rest from another year's hard labor and grief, that grief of which all of us get our share in actual railroad work, and I believe from all accounts that even general managers are not entirely free from it, and that reminds me, as all speakers say, of a story, and as I have fallen into the role of an amateur speaker I shall claim the privilege also of telling a story, albeit as my friends know that I never told a story unless it were true. I have told this story once before in public, but it is good enough to be repeated, and you know the hero of its origin perhaps better than I myself: When leaving the state of

Wisconsin in December last to go to my new field in Iowa and when coming through this beautiful city on my way to Chicago there was a conductor on the Chicago & Northwestern train who was an old gentleman, both in years of life and service, as shown by the great number of stripes on his left coat sleeve. One of the passengers in a seat adjacent to mine pointed to those merit marks and said, "Mr. Conductor, you have a great many of those stripes." The conductor said, "Yes, there are a good many of them, but there are some of them that you cannot see; they are on my back, they are grief." (Laughter.) This story has a sequel, and that is the point which I wish to get at. At the time spoken of, I was not acquainted with this conductor (who since was placed on the pension rolls), but about a month or six weeks ago I met him on a trip in Iowa which he was making in company with one of the general officers. I became quite well acquainted with the old gentleman, and in the course of my conversation with him I mentioned this incident. We had a hearty laugh about it, but he soon became quite serious and stated as follows: "You see, in the early days we had quite a little grief; we had poor equipment, primitive track facilities, track was not properly ballasted, trains were not what they should be; we had lots of snow to buck." But he said above all things, "we did not have as nice a lot of people to work for then as we have now-a-days." Without wishing to throw any bouquets, I want to say that the words spoken by this old gentleman represented the spirit permeating the members of this Association. They are true and staunch supporters of their employers and as every one knows there have been trying days not long since and there are trying days even at the present time, but these men, Mr. Aishton, are the loyal supporters of the railroad management. I thank you.

Mr. Aishton.—On behalf of the managers of the railroads, I wish to thank you. Joe may not be coming, but Rettinghouse has arrived. (Applause). Owing to other important appointments, I will have to ask to be excused,

and in leaving the convention, I wish you all a most profitable session, both for yourselves and for the railroads you represent, and if there is anything more that we can do for you, let us know and we will be glad to do it. I thank you.

President.—Next in order is the roll call.

Mr. Rettinghouse.—Inasmuch as we have a system of registration, I move the roll call be dispensed with.

Mr. W. O. Eggleston.—I second the motion.

President.—It has been regularly moved and seconded, that inasmuch as we have a system of registration, that we omit the roll call. Are you ready for the question? All in favor of that motion please signify by saying aye; those opposed, nay. The motion prevails, and I will ask all present to register, so we may have a complete record of all in attendance at this convention.

MEMBERS PRESENT.

ALDRICH, GROSVENOR, Superintendent Bridges, N. Y., N. H. & H. R. R., Readville, Mass.
 ANDERSON, L. J., Foreman Bridges and Buildings, C. & N. W. Ry., Escanaba, Mich.
 BAILEY, S. D., Division Foreman Buildings, M. C. Ry., Detroit, Mich.
 BENDER, H., General Foreman Bridges and Buildings, W. C. Ry., Fond du Lac, Wis.
 BROWN, J. B., General Foreman Bridges and Buildings, K. C. C. & S. Ry., Clinton, Mo.
 CRANE, HENRY (retired), C. & N. W. Ry., Janesville, Wis.
 CURTIN, WILLIAM, Foreman Bridges and Buildings, C. & N. W. Ry., Boone, Ia.
 CARR, CHARLES, Superintendent Buildings, M. C. R. R., Jackson, Mich.
 CLARK, W. M., Master Carpenter, B. & O. R. R., Youngstown, O.
 CANTY, J. P., Superintendent Bridges and Buildings, B. & M. R. R., Fitchburg, Mass.
 EGGLESTON, WILLIAM O., Inspector, Erie R. R., Huntington, Ind.
 EGGLESTON, H. H., Superintendent Bridges and Buildings, C. & A. R. R., Bloomington, Ill.
 FINLEY, W. H., Assistant Chief Engineer, C. & N. W. Ry., Chicago, Ill.

- FLYNN, M. J., Foreman Bridges and Buildings, C. & N. W. Ry., Chicago, Ill.
- FLETCHER, H. W. (retired), C. & N. W. Ry., 1813 Terman Ave., Allegheny, Pa.
- FULLEM, T. J., Superintendent Buildings, Ill. Cent. R. R., Chicago, Ill.
- GEARY, SYLVESTER, Master Carpenter, Penn. Lines, Cambridge, O.
- HUNCIKER, J., General Foreman Bridges, C. & N. W. Ry., 833 Was- sen St., Evanston, Ill.
- HUBBARD, A. B., Superintendent Bridges and Buildings, B. & M. R. R., 32 Banks St., West Somerville, Mass.
- HORNING, H. A., Assistant Superintendent Buildings, M. C. R. R., Jackson, Mich.
- HELMERS, N. F., Superintendent Bridges and Buildings, Mo. Pac. Ry., Minneapolis, Minn.
- HEELIN, R. F., Superintendent Bridges and Buildings, L. V. R. R., Sayre, Pa.
- HABWIG, W. E., Superintendent Bridges and Buildings, L. V. R. R., 168 Chamber St., Phillipsburg, N. J.
- HALL, THOMAS, Division Foreman, M. C. R. R., St. Thomas, Ont.
- INGALLS, F., Superintendent Bridges and Buildings, Nor. Pac. Ry., Jamestown, N. D.
- JUTTON, LEE, General Inspector, C. & N. W. Ry., Chicago, Ill.
- JOSLIN, J., Superintendent Bridges and Buildings, L. V. R. R., Auburn, N. Y.
- KILLAM, A. E., Inspector Bridges and Buildings, Intercolonial Ry., Moncton, N. B.
- KING, C. F., Foreman Bridges and Buildings, C. & N. W. Ry., Lander, Wyo.
- LOUGHNANE, GEORGE, Division Engineer, C. & N. W. Ry., Mason City, Ia.
- LICHTY, C. A., Inspector, C. & N. W. Ry., Chicago, Ill.
- LARGE, C. M., Master Carpenter, Penn. R. R., Jamestown, Pa.
- LEAKE, T. S., Superintendent Buildings, Mo. Pac. R. R., St. Louis, Mo.
- M McNAB, A., Superintendent Bridges and Buildings, P. M. R. R., Holland, Mich.
- McLEAN, NEIL, Master Carpenter, Erie R. R., Huntington, Ind.
- McKEEL, W. S., Master Carpenter, G. R. & I. Ry., Grand Rapids, Mich.
- MARKLEY, J. H., Superintendent Bridges and Buildings, T. P. & W. Ry., Peoria, Ill.
- MARKLEY, A. S., Master Carpenter, C. & E. I. Ry., Danville, Ill.
- MORRILL, H. P. (retired), C. & N. W. Ry., Madison, Wis.

- MUSSER, D. G., Master Carpenter, Penn. R. R., Wellsville, O.
 MONTZHEIMER, A., Chief Engineer, E., J. & E. R. R., Joliet, Ill.
 MILLER, A. F., Master Carpenter, Penn. Co., Chicago, Ill.
 NOON, WILLIAM M., Superintendent Bridges and Buildings, D., S.
 S. & A. Ry., Marquette, Mich.
 O'NEILL, P. J., Master Carpenter, L., S. & M. S. Ry., Adrian, Mich.
 PORTER, L. H., Superintendent Bridges, N. Y., N. H. & H. R. R.,
 Franklin, Mass.
 PERRY, W. W., Master Carpenter, P. & R. Ry., 147 Market St.,
 Williamsport, Pa.
 PATTERSON, S. F., General Foreman Bridges and Buildings, B. &
 M. R. R., Concord, N. H.
 PARKER, J. F., General Foreman Bridges and Buildings, A., T. &
 S. F. Ry., San Francisco, Cal.
 POWERS, GEORGE F., Superintendent Bridges and Buildings, E., J.
 & E. Ry., Joliet, Ill.
 POWELL, W. T., Superintendent Bridges and Buildings, Col. &
 Southern Ry., Denver, Col.
 PENWELL, J. N., Superintendent Bridges and Buildings, L. E. &
 W. Ry., Tipton, Ind.
 REYNOLDS, E. F., Inspector, C. & N. W. Ry., Antigo, Wis.
 RINEY, M., Foreman Bridges and Buildings, C. & N. W. Ry., Bara-
 boo, Wis.
 RICHEY, C. W., Master Carpenter, Penn. R. R., Pittsburg, Pa.
 RETTINGHOUSE, H., Division Engineer, C. & N. W. Ry., Boone, Ia.
 REID, R. H., Superintendent Bridges, L. S. & M. S. Ry., Cleve-
 land, O.
 ROBINSON, J. S., Division Engineer, C. & N. W. Ry., Chicago, Ill.
 STATEN, J. M., General Inspector, C. & O. R. R., Richmond, Va.
 SOLES, G. H., Superintendent Bridges and Buildings, P. & L. E.
 Ry., Pittsburg, Pa.
 SCHALL, F. E., Bridge Engineer, L. V. R. R., South Bethlehem, Pa.
 SWENSON, P., Superintendent Bridges and Buildings, Soo Line,
 Minneapolis, Minn.
 SWEATT, BARTON J., Contractor, Boone, Ia.
 STERN, I. F., Bridge Engineer, C. & N. W. Ry., 907 C. & N. W.
 Building, Chicago, Ill.
 SIBLEY, C. A., Inspector, Mo. Pac. Ry., St. Louis, Mo.
 THOMAS, C. E., General Foreman W. S., Ill. Cent. R. R., Chicago,
 Ill.
 THOMPSON, C., Assistant Superintendent Bridges and Buildings,
 C. L. E. & E. Ry., South Chicago, Ill.
 TRIPPE, H. M., Resident Engineer, C. & N. W. Ry., 320 12th St.,
 Milwaukee, Wis.

UPP, J. D., Master Carpenter, C., R. I. & P. Ry., Colorado Springs, Col.
 WEISE, F. E., Chief Clerk Bridges and Buildings Dept., C., M. & St. P. Ry., Railway Exchange, Chicago, Ill.
 WHITE, J. B., Foreman Water Supply, C. & N. W. Ry., Boone, Ia.
 WALDEN, W. D., Superintendent Mississippi River Bridge, C. & N. W. Ry., Clinton, Ia.
 WINTER, A. E., Division Engineer, C. & N. W. Ry., Escanaba, Mich.
 WELLS, J. M., Superintendent Bridges and Buildings, A., T. & S. F. Ry., Chillicothe, Ill.
 YAPPEN, ADOLPH, District Carpenter, C., M. & St. P. Ry., Western Ave., Chicago, Ill.
 ZOOK, D. C., Master Carpenter, Penn. R. R., Fort Wayne, Ind.

The following applicants for membership, subsequently elected, were also present:

ANDEBSON, A., L. S. & I. Ry., Marquette, Mich.
 AAGAARD, P., Ill. Cent. R. R., Chicago, Ill.
 BENNETT, A. G., C., M. & St. P. Ry., Minneapolis, Minn.
 DRUM, H. R., C., M. & St. P. Ry., Chamberlain, S. D.
 HOFECKER, PETER, L. V. R. R., Sayre, Pa.
 HADWIN, T. L. D., C., M. & St. P. Ry., Marion, Iowa.
 KING, F. E., C., M. & St. P. Ry., Milwaukee, Wis.
 MCKEE, J. L., Vandalia R. R., Spencer, Ind.
 PICKENS, J. E., Chicago Southern Ry., Watseka, Ill.
 ROSS, WM., C., M. & St. P. Ry., Milbank, S. D.
 STORCK, E. G., P. & R. Ry., Philadelphia, Pa.
 SCHUESSLER, W. B., N. Y., N. H. & H. R. R., New Haven, Conn.
 SWEENEY, W. M., C. & N. W. Ry., Fond du Lac, Wis.
 WELCH, E. T., C., St. P. M. & O. Ry., Mankato, Minn.
 WOLF, A. A., C., M. & St. P. Ry., Milwaukee, Wis.
 YOUNG, R. C., L. S. & I. Ry., Marquette, Mich.

President.—Next will be the reading of the minutes of the last meeting.

Secretary Patterson.—As the minutes have been printed and distributed, it has been customary to omit the reading of same.

President.—If there are no objections, the reading of the minutes will be dispensed with.

President.—Next will be the report of the Committee on

Applications for membership. The committee is composed of C. A. Lichty, and H. H. Eggleston.

One very important matter has been overlooked, that is the appointment of an assistant secretary for this meeting. I will therefore appoint Mr. Arthur Montzheimer as assistant secretary. Mr. Montzheimer, will you please step forward.

Mr. Lichty then presented the list of new applicants.

REPORT OF COMMITTEE ON APPLICATIONS.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

As chairman of the Committee on New Applications for Membership, I have the pleasure of naming the following gentlemen, who are recommended for membership:

AUGUST ANDERSON, Gen. For. B. and B., L. S. & I. Ry., Marquette, Mich.

J. A. BLAIR, Mast. Carp., P. R. R., Pittsburg, Pa.

J. W. BRATTEN, Gen. For. B. and B., S. P. Co., West Oakland, Cal.

J. TURNER BURKE, C. E., Liberty White R. R., McComb, Miss.

J. A. COSTOLO, Supvr. B. and B., Mo. Pac. Ry., St. Louis, Mo.

THOS. W. COTHRAN, Prin. Asst. Eng'r., Norfolk & Southern Ry., Greenwood, S. C.

RICHARD ORLANDO ELLIOTT, Asst. Supvr. B. and B., L. & N. R. R., Columbia, Tenn.

T. L. D. HADWEN, Asst. Engr. B. and B., C., M. & St. P. Ry., Marion, Ia.

PETER HOFECHEK, Supvr. B. and B., L. & N. R. R., Columbia, Tenn.

S. C. TANNER, Mast. Carp., B. & O. R. R., Cumberland, Md.

HENRY READ LEONARD, Engr. B. and B., P. R. R., Philadelphia, Pa.

A. M. MULLINIX, Supt. B. and B. and W. S., Ft. W. & D. C. Ry., Ft. Worth, Tex.

P. N. NELSON, Gen. For. of Carps., Southern Pacific Co., San Francisco.

J. V. NIMMO, Res. Engr., Atl., Que. & Western Ry. Co., Paspebiac, Que.

J. E. PICKENS, For. Water Supply Co., C. S. Ry., Watseka, Ill.

W. POLLARD, Asst. Gen. Br. Insp., Southern Pac. Co., San Francisco.

E. G. STORCK, Mast. Carp., P. & R. R. R., Philadelphia, Pa.

W. B. SCHUESSLER, Br. Supvr., N. Y., N. H. & H. Ry., New Haven.

C. THOMPSON, Asst. Supt. B. and B., C., L. S. & E. Ry., So. Chicago, Ill.
 E. T. WELCH, Supvr. B. and B., C., St. P., M. & O. Ry., Mankato, Minn.
 E. R. WENNER, Supvr. B. and B., L. V. R. R., Wilkesbarre, Pa.
 A. A. WOLF, Dist. Carp., C., M. & St. P. Ry., Milwaukee, Wis.
 WM. EL. WOOD, Div. Engr., C., M. & St. P. Ry., Marion, Ia.
 ROSCOE C. YOUNG, C. E., L. S. & Ishpeming Ry., Marquette, Mich.
 W. M. SWEENEY, For. B. and B., C. & N. W. Ry., Fond du Lac, Wis.
 J. B. WHITE, For. W. S., C. & N. W. Ry., Boone, Ia.
 R. E. MCFARLANE, Supvr. B. and B., N. P. Ry., Duluth, Minn.
 F. R. BARTLES, Supvr. B. and B., N. P. Ry., Fargo, No. Dak.
 C. S. McCULLY, Gen. For., N. P. Ry., Jamestown, No. Dak.
 HAWLEY R. DRUM, Chief Carp., C., M. & St. P., Chamberlain, So. Dak.
 J. L. McKEE, Master Carp., Vandalla R. R., Spencer, Ind.
 P. AAGAARD, Supvr. B. and B., Ill. Central R. R., Chicago.
 W. T. MAIN, Div. Engr., C. & N. W. Ry., Chicago.
 JOHN EWART, For. Pipers, B. & M. R. R., Boston, Mass.
 F. E. KING, Asst. Engr. B. and B., C., M. & St. P. Ry., Milwaukee, Wis.
 A. G. BENNETT, Asst. Engr., C., M. & St. P. Ry., Minneapolis, Minn.
 WM. ROSS, Chief Carp., C., M. & St. P. Ry., Millbank, So. Dak.
 L. H. TAYLOR, Asst. Gen. Br. Insp., C. & N. W. Ry., Chicago.
 A. R. SHEDD, Asst. Gen. Br. Insp., C. & N. W. Ry., Chicago.
 S. CHEATHAM, Supvr. B. and B., M. & O. Ry., Okoloma, Miss.
 HANS BENTELE, Asst. Chief Engr., Mexican Central Ry., City of Mexico, Mexico.

Mr. Rettinghouse.—I move that the secretary be instructed to cast one ballot for the election of these applicants.

Mr. A. S. Markley.—I will second that motion.

President.—It has been regularly moved and seconded that the secretary cast one vote or ballot for the admission of all these new applicants. All in favor of this motion, please signify by saying aye; contrary, nay. The motion is carried unanimously, and the secretary will please cast the ballot as directed.

Secretary.—I hereby cast the ballot, Mr. President.

President.—One ballot having been cast by the secretary, for the admission of these applicants, whose names have just been read, I declare them duly elected members

and entitled to all the rights and privileges of the Association.

President.—I will now declare a recess of five minutes for a reception for the new members.

Recess was thereupon taken, giving an opportunity to greet the new members present, after which the meeting was again called to order by President Markley.

President.—The next thing on the program is the president's annual address, and it will be a very brief one.

Ladies and Gentlemen, Members of the Association of Railway Superintendents of Bridges and Buildings:—For the seventeenth time, we are assembled for our Annual Convention. This city has extended invitations many times for our meetings, offering a number of inducements; other convention cities, telling of their many points of interest, have more to offer on paper than really exists. I am glad to say it is not so in this case, as Milwaukee is very famous and has been made so by extensive and expensive advertising; also, by some of the very largest manufacturers in this country and by many conventions and societies that have been so hospitably entertained and who have returned to their respective homes singing the praises of Milwaukee.

While I have been in this city only a short time, I have seen many of its points of interest. I could say much more to its credit, but do not think it necessary, as you have several days to spend in this beautiful city by the lake. It will take you all of that time and then you will not see all of its many points of beauty.

Before I proceed to the point where my remarks will not interest all of you, I want to say that I am pleased to be here today for more reasons than one; I am glad to see so many of the old and faithful members. It only goes to prove that they have confidence in their assistants whom they have left at home to manage their affairs. I am also glad to see so many strange and new faces before me. I know I can see some new, earnest, interesting, hard-working

members. I wish to extend to all of our many friends and guests a hearty welcome.

I am not going to detain you long, as I have not prepared a very lengthy address, for I wish to hear from other members. I am always willing to share the good things with you, and at all times have been a great listener and thinker. I would rather be seen than heard, and would prefer using the brains of others to help further the benefits of what my experience has taught me.

I am not holding this place today from a personal desire by any means, but to gratify the wishes of some of my friends—giving as their reasons that I, being a charter member, should lead the Association in the name of its president. In looking through our past proceedings, to learn what our former presidents had to say, in order that I may have something new to record, I decided after some deliberation I would say a few words on self-reliance.

Those of us who surrender our judgment to others are the ones who should benefit by these few words; the man who does this never will develop independence, stamina, stability, or self-reliance. It is far better to make a mistake than never to act. The man who says "I never made a mistake," in my opinion, made a mistake in having been born. People who are always asking for advice never amount to much. What makes a man is the standing for something definite. A man may be good and, when that is said, it is all; he simply stands for nothing else. It is very necessary to have a strong character. Firmness, decision, self-reliance, independence and amiability are the foundation and main supports of character, and it cannot be upheld without their support, for even the most brilliant qualities become useless without these stays. Attack your work to be its master, no matter how large or small; take the plans as your engineer or architect has planned the structure, and master its erection; show your superiors that you are strong, self-reliant, independent. This not only helps us to respect ourselves, but it has a tendency to draw respect from

others. Some men have plenty of good qualities, but are mere children in their self-reliance.

If in the past you have depended upon others for your opinions try the experiment of trusting yourself; knock out the false ideas that have been supporting you all these years, stand on "concrete," the coming building material, and you will be surprised at the amount of confidence you will have in yourself.

Just a few more words: I do not deem it necessary to say anything regarding our financial standing, as the secretary will make a full report. On the 20th of March, the Executive Committee met in Chicago. About all of the business that was transacted at this meeting was the changing of the location of our annual meeting place from Salt Lake City, Utah, to Milwaukee, Wis.

Since our last meeting, five of our members have resigned, leaving on our rolls 333 members with a number of new applications which have been accepted.

While we meet here this morning to enjoy the pleasure of greeting those who have been spared to met with us again, we are reminded of the uncertainty of life by the removal of three of our members by the grim reaper, Death: W. M. Keen of the N. Y., N. H. & H. Railroad, J. W. McCormack of the C., St. P., M. & O. R. R., Thomas Humphreys of the Southern Pacific Railway.

In conclusion, I wish to thank the chairman and the members of all of the committees for their work; I wish to thank you for the honor that you saw fit to bestow upon me. I feel, thus far, that I have had the full co-operation of all the members of this Association; I only hope for their continued good will throughout the meetings yet to come.

Just one more appeal I wish to make, and that is to urge all the members to attend every meeting, and to take an active part in discussing all of our subjects, remembering, gentlemen, that it is at these meetings that we make our record.

After the president delivered his address, a short recess

was taken to permit the ladies to depart from the hall, after which the meeting was again called to order by the president.

President.—I should like to state in reference to the Committee on Subjects that any member who has a subject to propose for our next meeting, should communicate with that committee; Mr. Clark and Mr. Schall are members of that committee. I also wish to ask all those who have not already done so, to please register on the registration card provided at the end of the convention hall, and that any new members who have not obtained badges will please call on the secretary and secure them. The special entertainment program will be out some time this afternoon.

President.—The next in order is the report of the Executive Committee.

The report of the Executive Committee was then read by Mr. Arthur Montzheimer, the assistant secretary.

REPORT OF THE EXECUTIVE COMMITTEE.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Agreeable to a call from the president the Executive Committee met at the Auditorium, Chicago, March 20, 1907.

Mr. C. A. Lichty acted as secretary *pro tempore*. Letters were read from several members, saying they could not attend our next Convention, if held in Salt Lake City, and recommended that the second choice, Milwaukee, be the next place of meeting; and after discussion by those present it was unanimously voted to change to Milwaukee, and it was recommended that a circular stating the change be sent out to all members and the technical press. Such circular was mailed as recommended. On motion, adjourned.

The Executive Committee was called together at the Republican House, Milwaukee, Wis., Monday evening, October 14, 1907. Mr. Lemond and Mr. Sweatt were absent. The minutes of last meeting were read and approved. The secretary reported the Association in a flourishing condition. Some discussion was had in regard to place of next meeting and of changing the name of the Association but no definite action was taken. No further business appearing, on motion, the meeting was adjourned.

S. F. PATTERSON,
Secretary.

President.—Gentlemen, you have heard the report of the Executive Committee, what is your pleasure?

Mr. Harwig.—I move the report be received and inserted in our Proceedings.

Mr. Large.—I second the motion.

Motion carried.

The report of the secretary was then read by Assistant Secretary Montzheimer.

REPORT OF SECRETARY.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your secretary submits the following report for the year ending October 15, 1907. After a very successful meeting of the Association held in Boston a year ago, the Association adjourned to meet in Salt Lake City, naming Milwaukee as a second choice. The Executive Committee received several letters from members of the Association strongly advocating the choice of Milwaukee instead of Salt Lake City as the next place of meeting, giving as their reason the great distance and the time necessarily consumed on the journey in reaching a city so distant; in consequence of this, the Executive Committee held a meeting in Chicago, March 20, 1907, and unanimously voted to fix upon Milwaukee. We are here today under very favorable circumstances and we hope that a large number may be in attendance.

We were requested to send a representative to the dedication of the Carnegie Engineering Building in New York City and our president appointed Mr. J. H. Cummin to that duty. Five members have resigned during the year, leaving now on our roll 335 names, with thirty new applications to be acted upon today. Thrice has death entered our ranks: Mr. W. H. Keen of the N. Y., N. H. & H. R. R.; Mr. J. W. McCormack of the C., St. P., M. & O. Ry., and Mr. Thomas Humphrey of the So. Pac. Co. The Committee on Memoirs and Obituary Notices will make proper mention of these deaths. The proceedings of the Boston Convention were printed and distributed as soon as possible after adjournment.

I wish to thank those members who have assisted me in securing new advertisements; all others, for their hearty coöperation, and to our advertisers, for their liberal patronage and kindly greetings.

FINANCIAL.

DR.

Balance in my hands at last report	\$116.44
Received for dues and fees	626.50
Received for advertisements	1,548.40
Received for sale of books.....	17.00

Total receipts \$2,308.34

CR.

By cash paid out for which I hold vouchers.....	\$1,958.49
Leaving a balance in my hands.....	349.85

Respectfully submitted,

S. F. PATTERSON,
Secretary.

President.—You have heard the report of the Secretary, what is your pleasure?

Moved by Mr. Clark that the report be received and referred to the Auditing Committee and placed in proceedings. Motion seconded and carried.

President.—Next in order will be the report of the Treasurer, which we will now have read by the assistant secretary.

REPORT OF THE TREASURER.

LAWRENCE, MASS., October 14, 1907.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your Treasurer submits the following report for the year ending October 15, 1907:

Cash on hand last report.....	\$987.11
Interest to May 1, 1907.....	33.04

Total on deposit.....\$1020.15

C. P. AUSTIN, *Treasurer.*

President.—You have heard the report of the Treasurer, what action will you take in regard to same?

Upon regular motion the Treasurer's report was referred to the Auditing Committee to be included in the printed proceedings.

President.—We will next hear the report of the Committee on Relief, which committee is composed of Mr. Arthur Montzheimer, J. P. Canty and Alexander C. Blake.

Assistant Secretary then read the report of Committee on Relief.

REPORT OF COMMITTEE ON RELIEF.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Relief which was appointed at the last annual meeting is glad to inform you that during the past year no requests for relief have been made.

ARTHUR MONTZHEIMER.
J. P. CANTY,
ALEXANDER C. BLAKE.

President.—What disposition do you wish to make of this report?

Mr. Harwig.—I move the report be received and inserted in our minutes.

Motion prevailed.

President.—Next will be the report of the Committee on Memoirs. Mr. J. T. Carpenter was on that committee.

REPORT OF COMMITTEE ON MEMOIRS.

PRINCETON, IND., October 14, 1907.

To the Association of Railway Superintendents of Bridges and Buildings:

GENTLEMEN: Your Committee on Memoirs for the current year beg to submit the following regarding the four members of this association who have died since our last meeting, namely, J. W. McCormack, Wm. H. Keen, Thomas Humphreys and John Schwartz:

MEMOIR.

J. W. MCCORMACK.

Mr. J. W. McCormack was born in 1861 in Wausau, Wis., but at the age of three years his parents moved to Blue Earth County, Miss., where he received most of his education in the district schools. He was married in 1885 at St. Claire, Minn., to Miss Katherine Cummins. In 1886 he entered the service of the C. St. P., M. & O. Ry., at Worthington, Miss., as a carpenter. Rapid advancement followed and in 1898 his earnest loyalty, integrity and capability brought a promotion to position of superintendent of bridges and buildings, in charge of the Eastern Division of the same road; during that year he moved to Altoona, Wis., where he resided until his death.

Mr. McCormack's illness lasted but one week, beginning with a cold which developed into pneumonia, which proved fatal.

The announcement of his death brought the message of grief to the hearts of all by whom he was beloved and highly esteemed, their deepest sympathy going out to those nearer and dearer ones thus sadly bereft of a father's tender love, when the Grim Reaper called him to his reward on January 24, 1907, at the age of forty-six years.

This Association hereby extends to his loved ones who have thus been bereft, our heartfelt sympathy in this their great loss, feeling very keenly as we do the removal by death of so valuable a man from our association.

MEMOIR.

WILLIAM H. KEEN.

William H. Keen was born at Duxbury, Mass., Aug. 23, 1832, and died March 12, 1907. He was the eldest son of William and Ruth (Humphrey) Keen, and was a descendant on his mother's side of Gov. William Bradford, the first acting governor of Massachusetts. At the age of twelve years he was apprenticed to a shipyard in Duxbury, where he learned the trade of a ship carpenter, which he followed until 1854, when he joined a surveying party on the Northern Pacific Railway. During 1859 he entered the service of the New York, New Haven & Hartford Railroad, continuing there four years. He then helped to build the Providence & Fiskill Railroad and remained with that road in charge of bridges and buildings until his retirement, February 1, 1907, with the exception of seven years with the Connecticut Western Railroad, making a total of forty-eight years' service with the lines now controlled by the New York, New Haven & Hartford Railroad, which is a very gratifying indication of his sterling worth as a man and of his earnestness, loyalty and capability to his chosen occupation and those whom he served. He joined this Association in 1904. He loved his home and spent all his time away from his business at home with his loved ones.

This Association hereby extends to his family our heartfelt sympathy in this their great bereavement, feeling keenly as we do the loss of so valuable a man from our Association.

MEMOIR.

THOMAS HUMPHREYS.

Thomas Humphreys, whose death occurred August 31, 1907, at Bakersfield, Cal., after an illness of over a year, had been employed by the Southern Pacific Railway for thirty-one years, twenty-one years of which time he was assistant to the resident engineer and in charge of bridge and building work on the Los Angeles, Mojave and San Joaquin divisions. Mr. Humphreys was a very competent man and exceptionally loyal to the company and his death was no doubt hastened several years by reason of exposure during the period of extensive washouts in the spring of 1905, at which time he was not in the best of health. His death is deeply regretted by his fellow employees, the members of this Association and all who knew him.

(Your committee regrets very much not having in their possession further particulars regarding Mr. Humphreys, the above being all the facts obtainable.)

MEMOIR.

JOHN C. SCHWARTZ.

Your committee regrets very much their inability to write a memoir on the death of our esteemed fellow-member, Mr. John C. Schwartz, whose death occurred since our last Convention, having been unable to secure any information regarding his life and career. Requests sent to his wife and to the superintendent under whom he was employed on the C., St. P., M. & O. Railway, met with no response, and would suggest that if any member present can furnish such information that he kindly write a memoir.

Respectfully submitted,

J. T. CARPENTER,
Southern Ry., Princeton, Ind.

Report received and ordered inserted in our minutes.

President.—The next in order will be appointing of the various committees, as follows:

Auditing Committee.—C. W. Ritchey, J. P. Canty, H. H. Eggleston.

Nominating Committee.—C. A. Lichty, A. Montzheimer, G. Aldrich, H. W. Fletcher, J. N. Penwell.

Committee on Resolutions.—R. H. Reid, H. Rettinghouse, Charles Carr.

Obituary Committee.—J. N. Penwell.

Mr. A. S. Markley.—As this concludes our morning services, I move we adjourn until 2 o'clock this p. m.

Motion was seconded and adjournment taken until afternoon session.

AFTERNOON SESSION.

TUESDAY, October 15, 1907.

President.—Gentlemen, you will please come to order.

President.—Gentlemen, I am pleased to announce that we will now listen to an address on the failure of the Quebec bridge, by the assistant chief engineer of the Chicago & Northwestern Railway Company at Chicago, Ill., Mr. W. H. Finley.

Mr. W. H. Finley.—Mr. Chairman, I wish I had a better subject than the one which has been assigned to me. I hardly feel able to speak with any degree of accuracy as to the cause of the failure of the Quebec bridge, as my information comes only from what I have read in the technical papers, and from some of my friends who visited the bridge, and not from any personal knowledge. The failure of the Quebec bridge was one of the most tragic events which has occurred in a great many years in the bridge building line. There have been in the past a number of failures and I will go back a few years and will take up first the failure of the Tay bridge in England. I think the Tay bridge failure occurred in 1879. The next greatest failure was that of the Ashtabula bridge, on the Lake Shore railroad, entailing a great loss of life and creating much suspicion in regard to the use of iron for bridge structures, as up to that time nearly all bridges in this country had been built with wood. This bridge was one of the early experiments in iron construction and was built at a time when iron was but very little understood. After the failure which occurred to the Ashtabula bridge, the question arose among engineers and also laymen, as to whether iron was a satisfactory material for bridge structures. It was discussed both in the technical and lay press. The reason or the cause of the failure of the Ashtabula bridge was due to the desire of its designers to reproduce in iron the same type of construction previously followed in wood, and it not only resulted in a great loss of life, but the chief engineer of the bridge took his own life because his humiliation was so great. Coming to the Quebec bridge, there has probably been no bridge built in recent years that has arrested the attention and attracted the admiration of engineers and laymen as that bridge has, in the accuracy with which the problems of erection were worked out. Everything was absolutely determined beforehand, and during the progress of the erection everything went forward with clock-like regularity. The placing and movement of every piece was carefully worked out before-

hand and there was nothing left to be solved in the field. Of course when this accident occurred, the first question which arose was whether the engineers had constructed a safe length of span that could be built in steel, and there were a great many expressions of opinion to the effect that they had not constructed that which was safe, in the length of span of modern material. The same opinion of course was expressed in the case of the failure of the Ashtabula bridge. There was nothing in the length of the span of the Quebec bridge that warranted its failure. Such spans will be built and greater spans will be built in the future if necessity demands it. The Quebec bridge exceeded the Firth of Forth bridge in England by something like ninety feet in the length of span, and it is a type of bridge of which there is no difficulty in determining the stresses.

The American engineers' first thought after the failure of the Quebec bridge was a comparison between that bridge and the Firth of Forth bridge, but the fact that the Firth of Forth bridge stood and the Quebec failed is not conclusive one way or the other, as to the methods employed in the erection of the Quebec bridge. From what I can gather from those who have examined and reported on it, the consensus of opinion is that the weakness of the bridge that caused the failure was due to the lack of sufficient bracing in the bottom chord members. It is difficult, of course, for any one to state definitely and positively just what the cause of the failure was. There is a commission now investigating the same and I trust they will be able to decide upon something convincing. This bridge was built by one of the oldest and best known bridge companies in the United States, a bridge company that has a corps of engineers that are known the world over for the work produced in the past. The plans were supposed to have been revised by one of the ablest bridge engineers this country has produced, Mr. Theodore Cooper of New York City.

Of course it is very easy to speculate, but in the absence

of any direct knowledge I would hardly hazard an opinion as to why the bridge failed. There was one very striking difference between the Firth of Forth and Quebec bridges, and that is that the design of the Quebec bridge has been open to the world. The stress sheets have been published and have been a matter of record ever since the bridge was first started. The type details and mode of manufacture have all been a matter of record. While with the Firth of Forth bridge there was never a stress sheet published. I have never seen one in all the technical literature published by either the American or English papers, while the Quebec people did give to the world the methods they employed and details they were going to use. The criticism made in regard to the Firth of Forth bridge by the American engineers was that it was extravagant, that it was wasteful in material, and could have been built with very much less material, with satisfactory results, but of course the Firth of Forth bridge stands while the Quebec bridge is a scrap. I hardly like to state positively just what my opinion is of the cause of the failure of the Quebec bridge, but I will say that so far as the evidence has been made public, it seems that the direct cause was a weakness in the compression members of the bottom chords of the anchor span. The American type of bridge was used in the construction of the Quebec bridge. This pin and link type of bridge is a type of bridge that has been built the world over, not only in this country but also in Africa, in South America and in India. The American bridge spans the streams of those countries. This failure of the Quebec bridge does not in any way invalidate the type of bridge used. In general appearance nothing was handsomer than the Quebec bridge. The fact that it fell in the way it did of course has naturally brought a great many theories to the front, outside of the question of the failure of the compression members of the bottom chord of the anchor span. The building of the Quebec bridge was not as great an undertaking as has occurred in previous years, in 1863 and '64,

when the Pennsylvania railroad wanted to cross the Ohio River at Steubenville. The river interests at that time were very powerful, and a bill was passed in the legislature prohibiting any spans across the river of less than a three hundred foot clear span. This was done with the idea that it was impossible to build a span longer than two hundred and fifty feet with steel or iron. After this bill was passed by the legislature, Mr. J. Edgar Thompson, then president of the Pennsylvania Railroad, and, by the way, a very competent engineer himself, called in his bridge engineer, Mr. Linville, and put the question to him. Mr. Linville said, "Yes, I can build it, with a clear span of three hundred feet across the Ohio River," but he insisted that he should be given an opportunity to test the materials, on account of the length that he would be required to use in this bridge, which was greater than anything previously used in a metallic structure. This was given him, and testing machines were built, and Mr. Linville made tests of the full-sized members, and built his bridge, giving a three hundred foot clear span, and this bridge was made up of cast iron top chords and cast iron posts and designed for a rolling load of three thousand pounds per lineal foot. And the building of that bridge at that time was a much greater undertaking, requiring much more study and much more research, than the building of the Quebec bridge at this time, for the reason that in the meantime we have added to the knowledge and experience gained at that time by the tests made at the United States government laboratory and tests made by official investigators. I do not know of anything more interesting today to any one engaged in the designing and maintenance of structures than a careful study of the Quebec bridge and the Firth of Forth bridge. The methods and designs and details were so absolutely different that it will well repay any one to make a comparison of the two. In the Quebec bridge everything was perfected in the shop and sent to the field so marked and so arranged that it would be imme-

diately put in place, and special machinery was designed so that nothing was left to the erecting force in the field to figure out as to how to place this member or that member. That was all carefully worked out beforehand.

Just for the benefit of the members of the Association present, I will state that my own opinion is that the failure was undoubtedly due to the compression members giving way. If it had been due to the faulty connecting of a joint the bridge would have twisted out of shape. But as a matter of fact, from the very best evidence obtainable, it was a gradual sinking or failure of the structure as a whole, and this idea is best borne out by the supposition of a failure of the compression members in the bottom chord of the anchor span. If these members failed, as it is supposed they did, it would naturally have resulted in a slow advance movement and gradual dropping of the cantilever arm until the point of rupture had been past and then a collapse of the whole as evidently took place from the best evidence we have at hand. I do not think, however, that the failure of this bridge is in any way an indictment of the American type of construction. The American type of construction has been used too extensively, and in too many cases to be called into question today by a failure of this kind. I have no doubt in my mind but that the Quebec bridge will be rebuilt, practically on the same lines on which it was started. There may be some modifications in the details in the light of the evidence that may be produced in the failure of this bridge, but I am more than satisfied that it will not only be built, but longer cantilever bridges will be built if the necessity arises for their construction. The only thing to do in cases like this is to suspend judgment until there is an official determination of the cause of the failure. Of course we all feel humiliated to think that a bridge put up by a company with the reputation of the Phenix Bridge Co., revised by a bridge engineer with international reputation, Mr. Theodore Cooper of New York City, could fail, but such is the fact. It has

failed. But on the other hand, I expect it to rise from the scrap heap and that we will yet see at Quebec a bridge that will meet every requirement and be a monument to the engineering profession. (Applause.)

President.—Mr. Finley, on behalf of the Association, I wish to thank you for these remarks which have certainly been very interesting.

President.—Next in order is the report of the Auditing and Nominating Committee. In order to gain time, while we are waiting on the Auditing and Nominating Committee to report, we will proceed with the next business, which is the reading of reports of committees on subjects for reports and investigation. The first is subject number one, "Experience in Concrete Bridges, Arches and Subways," with Mr. W. H. Finley, chairman.

Mr. W. O. Eggleston.—I would suggest that we dispense with the reading of those reports in detail.

Mr. A. S. Markley.—Where the reports of these committees have been published, as is the usual case, and are here before the members, I agree with Mr. Eggleston that considerable time would be required, and I move that we dispense with the reading of the reports and that they be distributed, so that the members here can read them at their leisure.

Mr. Staten.—I will second that motion.

President.—It has been regularly moved and seconded that we dispense with the reading of these reports. All in favor of the motion please say aye, those opposed nay. Motion is carried.

Mr. A. S. Markley.—What is subject number one?

President.—"Experience in Concrete Bridges, Arches and Subways."

President.—There is no report on subject number one. (No report.)

President.—Subject number two, "Concrete Building Construction," Mr. A. O. Cunningham, chairman. We have a report on this. (See report on subject number two.)

President.—As we have dispensed with the reading of these reports the next thing in order will be unfinished business. What is there in that line?

President.—If there is nothing in that line, the next in order to be taken up is new business.

Mr. A. S. Markley.—Under this head would come the business transacted by the Executive Committee last night, with reference to changing the name of the Association, etc.

President.—In the absence of the Secretary, I will outline this matter. Last evening at the Executive Committee meeting the matter of changing the name of the Association was brought up and Mr. Lichty suggested the only name and that was, if I remember correctly, "American Railway Bridge & Building Association." That was the only name suggested. Would like to hear from the members on this matter.

Mr. A. S. Markley.—What do our by-laws and constitution require in regard to this change, and can it be acted upon at this meeting? Will you have the assistant secretary read that part of the by-laws?

President.—Yes, sir.

Assistant Secretary thereupon read the by-laws, Article 10, Section 1, under the head of Amendments, as follows:

"The constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that a written notice of the proposed amendment has been given at least ninety days previous."

President.—As I understand it, there is no objection to the adoption of a name at this meeting and then have a vote taken by a letter ballot ninety days later, so that will clear up that part of it.

Mr. Reid.—We have members from New Zealand, Australia, and in selecting a name I think it might be well to make it the Railway Bridge and Building Association, leaving off the word American.

Mr. A. S. Markley.—I think that point is well taken, and that it would be a wise thing to leave off the word Ameri-

can, as we have members in New Zealand and foreign countries, and they might take exceptions to it. Even our old friend, Mr. Killam, might take exception.

Mr. Killam.—Anything in North America will satisfy me.

Mr. Penwell.—I think it might be well to have those who proposed the changing of the name explain to this Convention why they wish to change the name, and what the objections are to the present name of the Association, and what benefit would be derived by making the change. I do not know who brought it about, but it seems to me in order to get the matter properly before the Convention, some one who has suggested the change should give us his reasons for it, then every one could discuss it and leave it for the final vote.

President.—Mr. Lichty is the father of the movement. He is out at the present time on committee work, but will probably be in soon, but I presume there is no objection to talking the matter over.

Mr. Montzheimer.—I was present at the Executive Committee meeting last night when this subject was brought up. Mr. Lichty is chairman of the Membership Committee and in endeavoring to get new members into the Association, a number of them stated that they did not know that they were eligible, as they were not superintendents of bridges and buildings, and nowadays a great many of the roads have men performing the duties of superintendents of bridges and buildings, but under different titles, such as master carpenter, supervisor of bridges and buildings and other titles, such as foreman, and he thought that it would be better if we should leave out the word superintendent and have the name read American Railway Bridges and Building Association, and it seems to me it would be more descriptive of the work if the name of the Association was changed as proposed, because we have not only superintendents of bridges and buildings, but we have bridge engineers, assistant engineers and chief engineers, as well as

superintendents of bridges and buildings and supervisors of bridges and buildings, master carpenters, etc.

Mr. Killam.—In Canada we are known as inspectors.

Mr. A. S. Markley.—I move that the change be made in accordance with the constitution to read Railway Bridges & Building Association.

Mr. Aldrich.—I would like to ask if it is possible to suspend that rule requiring ninety days' notice.

President.—No, sir, it is not, Mr. Aldrich.

Mr. Penwell.—I had in mind a name for this Association, before Mr. Markley made his motion, and that is that it be called the International Association of Railway Bridges & Buildings.

Mr. Reid.—If we are going to adopt a new title I think we should make it as short as we can, and cover the lines of work we have to do. The shorter name is preferable to a long one, for as a rule, with a long title all you will get out of it will be a long string of letters, and I think Railway Bridge & Building Association covers practically all the work that every one does on all the different lines they are working on, and I think that is the best title that has been suggested.

President.—I would like to hear from all the members that are interested in this matter. Those who are here can well remember that when that word International was attached to the name at St. Louis, when organized seventeen years ago, that it caused considerable comment on account of the length of name.

Mr. Penwell.—I see you are trying to shorten the name. That was not a motion of mine, but I will withdraw it.

Mr. Sibley.—As this is an American society, I should be very much in favor of including the word American, making it read American Railway Bridges & Building Association, and I do not believe any of our members are so sensitive that they would object to it.

Secretary.—If the name of the Association is to be changed it is going to entail a lot of extra expense, and I

am looking after the dollars. All our stationery will have to be changed, and these badges will have to be thrown away, and they cost \$75 per hundred.

Mr. Stearn.—For my own part, I think it would be a good idea to throw them away and have some ordinary copper buttons, something simple that can be worn around all the time, without feeling that you are carrying a junk shop, and I, for one, think it would be a good thing to do and to order something in the way of a button, like the American Society of Maintenance of Way, that we could wear all the time.

Mr. Schall.—It seems to me that Mr. Lichty or whoever is chairman of the Membership Committee of this Association could prepare a little pamphlet showing the qualifications that are required. The name does not amount to much, and these could be furnished to any man who wishes to become a member of this Association, and when a man is asked to join an association these could be sent along with the application, showing what the requirements are, and thus avoid any change in the name of the Association.

Mr. A. S. Markley.—I believe the qualifications are pretty well covered in our by-laws. I am not myself in sympathy with this change. I am heartily in favor of the idea of keeping it as it is, for the reason, as Mr. Schall says, the name does not make much difference.

Mr. W. O. Eggleston.—Why cannot our application blanks be revised to cover the requirements of a man making application for membership here, and when sent out inform him whether he was eligible or not, and I will make that as a motion.

Mr. A. S. Markley.—I second that motion.

President.—All those in favor of that motion please signify by saying aye, those opposed, nay. Motion is carried unanimously, and we will now drop the matter of changing the name of the Association.

Secretary.—Last year at the meeting of the Convention in Boston, it was suggested by a number of the members

that the name of Mr. E. H. R. Green be transferred to the life membership roll, and I did so, and I would ask this convention to ratify that act if they so desire. Some of the members may not know who Mr. Green is, and I will state for their information that he is the general manager of the Texas Midland Railway Company and has been a member of this Association for a good many years, has paid his dues, and that he presented us with a beautiful banner which was displayed at Boston, the banner costing \$100 or more. He has never attended any of our meetings and we thought under the circumstances it would be a wise thing to do, to transfer his name to the list of life members. I notified him we had done so and received a very nice letter from him acknowledging the courtesy. He seemed to appreciate it very much.

Mr. Parker.—I move that the action of the Secretary be ratified, transferring Mr. Green to the life membership roll.

Mr. Large.—I second that motion.

Motion carried.

President.—Next is a discussion of last year's reports. The first is number one, "Concrete Bridges."

Mr. Clark.—I wish to say a few words before we pass away from new business, if I can, Mr. President. In talking with one of the Past Presidents of our Association, Mr. G. W. Andrews, several times in the last year, he stated that in regard to our meetings while he would like to attend them very much, and he always did take a strong interest in them, at this time of the year it was impossible for him to attend, and while he did not ask me or make any request of me to bring the matter before you, in his conversation, he thought if we would change to some other time of the year that it would not only accommodate him, but several members of the Association. Now I know this matter has been brought up and talked over a number of times and always left right where it started, and with all courtesy I now bring it up and would like to have an expression from

the members as to whether we are holding our meetings in the most advantageous time of the year. Or if we should change to any other part of the year, whether it would be an advantage to a greater number.

Mr. Reid.—I think the idea is a good one. I think it has occurred to a good many of us that it is difficult to get away at this time of the year. As a general rule, most of the railroads are just closing up the season's work, which has possibly been delayed through the summer, and trying to get it settled before the fall rains and ice and other troubles begin. There is undoubtedly a good many who could attend in the winter or some other time who cannot attend in October. Of course October is a pleasant time for many, but it is the most difficult time in the whole year for me to get away, and if we can see our way clear to hold the meetings in the latter part of January or February, I think we could get a larger attendance, and that more members could leave at that time of the year, as the bridge and building work is comparatively lighter and the new year's work not yet started. It seems to me January or February would be more preferable.

Mr. Penwell.—This question has been up for discussion several times, and there are a number of things to think of. It is an important move if we change the time of meeting. For myself February is the busiest month in the year. June is my best time to get away; there is less work then than in any month in the year. And if we make it in the middle of the winter we would spoil it for our ladies, and if we spoil it for our ladies we would be spoiling a great feature of our convention. I myself in January and February am confined to the office all the time. October is good enough for me and I move that we defer this question until the next annual meeting, next October, and that this question be laid over until that time and then be disposed of.

Mr. Staten.—I will second that motion.

President.—It has been regularly moved and seconded

that the matter of changing the date of our meetings be laid over until next October. Are you ready for the question.

Mr. Staten.—For seventeen years we have been meeting in October and have been very successful, and this is testified to by the number present at this meeting. I should regret very much to see it changed to any other month. It is impossible to arrange our annual meeting so as to please every one, or to accommodate all of the members, and we wish above all things to accommodate the ladies.

Mr. Killam.—In looking over the situation, north, south, east and west over this country, it appears to me in reference to changing the date of meeting that at various places in this country you have snow blockades and trains that do not always arrive on time, but during the month of October for the last ten years, I have found that we have always had a good attendance of people coming from every part of the country. There are some that have probably as much to do at that time as any other time. Perhaps the month of November would be a little better on account of inspections, but I for one will stand for October.

Mr. Perry.—For my part I prefer October. October is the best month for me, and that month suits me best.

Mr. Parker.—This time would suit me better than any other in the year. You could hardly expect a man from Southern California to come into this country in the month of January. (Laughter.)

Mr. Staten.—I make an amendment to the motion before the house that we leave the date as it is.

Mr. Parker.—I will second that amendment.

Upon regular vote being taken the amendment was unanimously carried.

President.—We will proceed now with the discussions of last year's reports. The first one, "Concrete Bridges, Arches and Subways." The committee was L. H. Lafontaine, R. H. Reid, G. E. Hanks, A. S. Markley, H. D.

Cleveland, and Moses Burpee. I think there was no report last year.

Mr. A. S. Markley.—No, sir, there was no report last year, and it was carried over to this year and a new committee appointed. (No discussion.)

President.—The second one is "Experience in the use of Concrete and Timber Piles." The committee was composed of W. H. Finley, E. N. Layfield, W. S. Dawley and L. D. Smith. There was no report. (No discussion.)

President.—No, three was "Concrete Building Construction." No report, and this was carried over to this year and a new committee appointed. (No discussion.)

President.—Number four was "Method of Watering Stock in Transit." Mr. Penwell was chairman of that committee and there was a good report made, together with a supplementary report by W. A. Pettis, and also another supplementary report by R. H. Howard, and we would now be pleased to have a discussion on this report.

(See discussion on last year's report, number four, "Method of Watering Stock in Transit.")

President.—The next will be report on subject number five, "Recent Practice in Cofferdam Work." Mr. G. Aldrich, committee. There was also a supplementary report made last year by Mr. Schall, Walter G. Berg and E. B. Ashby. This is a subject that ought to be interesting to all.

(See discussion on last year's subject, number five, "Recent Practice in Cofferdam Work.")

President.—The next is subject number six, "Modern Coaling Stations and Cinder Pits," Mr. J. S. Browne, chairman. Has any member anything to say on this subject? If not we will pass it and proceed with the next subject, which is number seven.

(No discussion on subject number six, "Modern Coaling Stations and Cinder Pits.")

President.—We are now ready to take up subject number seven, "Construction of Bumping Posts for Passenger and Freight Cars." Mr. A. E. Killam was the chairman of that

committee. Has any member anything they wish to say on this subject?

(See discussion on subject number seven, "Construction of Bumping Posts for Passenger and Freight Cars.")

President.—If there is nothing more on this subject we will pass it and go on with the next business, which will be discussion of reports of the standing committees. The first subject is number one, "Pile and Frame Trestle Bridges," Mr. W. E. Smith, chairman. I believe we have no report on this, but we can have a discussion if you so desire.

(See discussion on standing subject number one, "Pile and Frame Trestle Bridges.")

W. O. Eggleston.—I move that we now adjourn until 9 o'clock tomorrow morning. Motion was duly seconded and carried and adjournment taken until Wednesday morning.

MORNING SESSION.

WEDNESDAY, October 16, 1907.

President.—Gentlemen, you will please come to order. I am pleased to announce that Dr. W. K. Hatt, Professor of Civil Engineering at Purdue University at Lafayette, Ind., and director of timber tests of the forest service of the United States Department of Agriculture, will be here at 10.30 this morning to make an address on the strength of timber, and I should like to have all the members present at that hour.

President.—I will ask first this morning if any committee is ready to report.

Mr. Montzheimer.—Here is the report of the Auditing Committee.

REPORT OF AUDITING COMMITTEE.

MILWAUKEE, WIS., October 15, 1907.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Secretary's report as per your Auditing Committee:

RECEIPTS.

Cash on hand last report	\$116.44
Received in dues and membership fees.....	626.50
Received for sale of books.....	17.00
Received for advertising.....	1,548.40
Total receipts	<u>\$2,308.34</u>

DISBURSEMENTS.

Expenses as per receipted bills	\$1,358.49
Secretary's salary	600.00
	<u>\$1,958.49</u>
Balance in Secretary's hands Oct. 15, 1907.....	\$349.85
Balance in Treasurer's hands same date.....	1,020.15
Cash balance on hand.....	<u>\$1,370.00</u>

C. W. RICHEY,
H. H. EGGLESTON,
J. P. CANTY,
Auditing Committee.

President.—You have heard the report of the Auditing Committee. What is your pleasure?

Mr. A. S. Markley.—I move that it be received and published in our proceedings.

Mr. Large.—I second that motion.

President.—All who are in favor of this motion please signify by saying aye. It is carried unanimously.

President.—If no other reports we will now go on with the regular business.

President.—I have just been informed that the Nominating Committee is ready to report, and before proceeding with other business we will listen to their report, which I will ask the Assistant Secretary to read.

REPORT OF COMMITTEE ON NOMINATIONS.

MILWAUKEE, Wis., Oct. 16, 1907.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Nominations submits the following report for officers for the ensuing year:

For President—R. H. Reid, L. S. & M. S. Ry.
 First Vice-President—J. P. Canty, B. & M. R. R.
 Second Vice-President—H. Rettinghouse, C. & N. W. Ry.
 Third Vice-President—F. E. Schall, L. V. R. R.
 Fourth Vice-President—W. O. Eggleston.
 Secretary—S. F. Patterson, B. & M. R. R.
 Treasurer—C. P. Austin, B. & M. R. R.
 Executive Members—A. E. Killam, Intercolonial Ry.;
 J. S. Lemond, Southern Ry.; C. W. Richey, P. R. R.;
 T. S. Leake, Mo. Pac. Ry.; W. H. Finley, C. & N. W.
 Ry.; J. N. Penwell, L. E. & W. R. R.
 C. A. LICHTY, *Chairman*,
 H. W. FLETCHER,
 J. N. PENWELL,
 G. ALDRICH,
 A. MONTZHEIMER,
Committee.

President.—Gentlemen, you have heard this report and you will please bear in mind that this report of the regular Nominating Committee does not in any way interfere with any member of this Association naming others if he wishes as officers of this Association.

Mr. A. S. Markley.—I move that this report be received and printed in our proceedings.

Motion seconded and carried.

Mr. Killam.—I think according to parliamentary rules, the first member named on the Executive Committee would be the chairman, and I being so far east would find it difficult to act as chairman.

Assistant Secretary.—While in the ordinary run of business the first one named is considered chairman, still there is nothing in the constitution to cover that; as a matter of fact the President and Secretary of the Association are members of the Executive Committee, and the President naturally is chairman, and it has been that way now for four or five years.

President.—We will now proceed where we left off on the

discussions of standing committee subjects. Subject number one, "Pile and Frame Trestle Bridges." Some member seemed to be interested in covering the stringers and caps with galvanized iron or something of that kind to prevent decay.

(See continuation of discussion on subject number one, "Pile and Frame Trestle Bridges.")

President.—I am very glad to announce that we now have with us Prof. Hatt of Purdue University, who will give us a talk on the strength of timber, and I take pleasure in introducing Dr. Hatt.

Prof. W. K. Hatt.—Mr. President and Members of the Association: I do not wish to take up your time trying to inform you upon the subjects which you know more about than I do, but I do want to interest you in some way in the work of the forest service of the United States Department of Agriculture, in its work of investigation of the strength of timber, which I would say is appropriate for this Association to consider.

TIMBER TESTS OF FOREST SERVICE.

I would not presume to take up the time of this Association in an attempt to instruct the members concerning matters in which their experience has been profound and extensive. I do, however, wish to call attention to the Forest Service in making tests of structural timber.

This topic is not inappropriate for the reason that anyone who attempts, at the present time, to search the records relating to the strength of timber is led to the very important and thorough work of the committee of this Association under the chairmanship of Walter Berg, which, at the 5th annual convention at New Orleans, October, 1905, made a report on the strength of timber as far as it was at that time known.

This committee found the subject in a chaotic state. The strength of a given species was quoted in hand-books in greatly different values. In some cases the values were

found by tests of small clear sticks of thoroughly seasoned timber, and in other cases from tests of large structural timber full of defects, and green.

In many cases the reporter of the tests had neglected to record the description of the material tested. The up-shot of the whole matter was that there was very little certain knowledge of the actual strength of timbers that went into structures, and the degree of variation to be expected, and no information which would enable anyone to determine the relations between the various defects which occur in an element like a bridge stringer, such as knots, shakes, etc., and the strength of that stringer, specifications which were handed down from one engineer to another containing unnecessary and meaningless clauses.

In response to the demand of the public, and as a result of the realization of the fact that there was so little information available to form the basis of answers to the questions that it was called upon to answer, the Forest Service in 1902 took up this matter and began a new series of timber tests. Then, too, the Forest Service is charged with the administration of large areas of forest in the national forests and it became necessary to study the best uses of the timber being grown in these national forests. Laboratories were established at New Haven, Conn., Washington, D. C., Purdue University, Lafayette, Ind., University of California, Berkeley, Cal., University of Oregon, Eugene, Or., and University of Washington, Seattle. The work was organized and directed by the speaker. The results of the operation of these laboratories are gradually becoming available. What follows is information gleaned from the various reports that have been published.

ELEMENTS AFFECTING THE STRENGTH OF STRUCTURAL TIMBER.

The most obvious characteristic of the cross section of a trunk is the distinction between heart-wood and sap-wood. The heart-wood represents that part of the tree that was

once sapwood and shared in the life process of the tree, but which now is dead. Sap-wood, on the contrary, is the medium through which the circulation from the root to the leaves takes place between the bark and the heart-wood. It usually happens that in large trees sap-wood is wood that has been put on in the old age of the tree. The elements affecting the change from sap-wood to heart-wood in the case of various species, and the rate in which this change takes place, are matters which are not well understood at the present time. But certainly the size of cells and thickness of cell walls and other similar characteristics of the wood, are determined before the wood has changed from sap-wood to heart-wood. There is no reason to suppose, therefore, that there would be any essential difference in strength between heart-wood of itself and sap-wood of itself. Any difference between the strength of the wood which has become heart-wood and that wood which is at present sap-wood is due to other considerations. Sap-wood may be stronger than heart-wood and *vice versa*.

RINGS PER INCH.

Another obvious feature between the wood in the cross section of a trunk is in the rings which run around the center. Each ring is composed of two kinds of growth, called spring-wood and summer-wood. Each ring represents the annual growth of a tree. Thus a trunk showing five rings in an inch increased its radius by one inch and its diameter by two inches in the course of five years. Trees vary greatly in their rate of growth. Some species grow rapidly, some very slowly. A tree of a given species will grow rapidly if well fed and well lighted, and more slowly when shaded out by other individuals. Some species grow rapidly when young, and others very slowly when young. The rings are generally very narrow at the exterior of large trees.

For instance, this specimen of loblolly pine for the first seven years of its life increased its diameter one inch each

TABLE 2.—SUMMARY OF THE AVERAGE BENDING STRENGTH OF STRUCTURAL TIMBER.

(In large sizes.)

Reference number.	Species and locality of growth.	Grade.	Condition.	Number of tests.	Moisture, per cent.	Weight per cubic foot.		Modulus of rupture.	Modulus of elasticity.
						As tested.	Oven dry.		
1	LOBLOLLY PINE. South Carolina.	Square edge...	Green	42	48.0	Lbs. 46.2	Lbs. 31.2	Lbs.sq. in. 5,530 ₇	1,000 lbs.sq. in. 1,426
2	LONGLEAF PINE. South Carolina and Georgia	Merchantable..	Partially air dry	44	26.1	49.8	39.5	7,772 ₁₁	1,690
3	DOUGLAS FIR. Oregon and Washington	All grades	Partially air dry	216	22.1	33.8	27.7	6,975 ₅₄	1,600
4	Oregon and Washington	Select and mer- chantable	Partially air dry	164	22.0	33.9	27.7	7,500 ₄₈	1,686
5	Oregon	All grades	Green.....	135	30.9	38.4	29.4	6,140 ₁₈	1,526
6	Oregon	Select and mer- chantable	Green.....	103	31.3	38.6	29.4	6,490 ₃₄	1,585
7	WESTERN HEM- LOCK. Oregon and Washington	All grades.....	Partially air dry	64	27.8	33.2	26.0	5,992 ₁₁	1,351
8	Washington.....	All grades.....	Green.....	30	36.2	38.8	28.5	5,783 ₁₈	1,475
9	TAMARACK. Minnesota	Merchantable .	Green.....	30	50.6	45.2	30.1	4,562 ₄	1,219
10	NORWAY PINE. Minnesota	Merchantable..	Green.....	49	47.8	37.4	25.4	3,975 ₇	1,189

NOTE.—Figures written as subscripts to the figures for modulus of rupture indicate the number of sticks failing in longitudinal shear. (From Circular 115, Forest Service.)

year, whereas this specimen of longleaf pine for the first eight years of its life increased its diameter less than one eighth of an inch per year. This specimen of Douglass fir when young grew one half inch in diameter each year. This piece of longleaf pine has nineteen rings per inch at the outer edge of the heart-wood and this piece of Douglass fir has forty-two rings per inch near the bark. We know, then, in general, that there is a comparatively quick growth and wide rings near the center, and a slower growth near the bark.

SUMMER WOOD AND SPRING WOOD.

Looking more closely at any one annual ring, two kinds of growth may be distinguished; in the case of the conifers a hard, dense, dark-colored portion of the ring and a light softer portion. The light softer portion is put on during the spring and is called spring-wood, and the heavy, dense portion is put on during the summer and is called summer-wood. In the spring-wood the cells are large, with thin walls, and in the summer-wood the cells are smaller, with thick walls. Different species vary in the rate of change between spring and summer-wood. Douglass fir presents a very sharp contrast between the outside of summer growth of one year and the beginning of spring growth of the next year.

The proportion of summer-wood is the main element in the strength and weight of a piece of wood. In the case of conifers the summer-wood of itself is about twice as strong as the spring-wood. The strength and weight of a piece of wood are directly in proportion to the percentage of summer-wood present. If a line is drawn from the center of a coniferous tree to the bark, the percentage of summer-wood increases and reaches its maximum at about two thirds of the distance and then diminishes. In the loblolly pine, which is almost entirely sap-wood, the best growth, which is thus sap-wood, is found about three fourths of the distance from the pith and the more narrow ringed and ex-

terior portion is weaker. In the long leaf pine the best wood is heart-wood and the more narrow ringed portion of sap-wood is of slower growth and also weaker.

Similar facts may be worked out with reference to the hard woods also. This address only considers the conifers. It is well known, for instance, that the best hickory is the second growth, sap hickory with wide solid rings. This is much tougher and stronger than the narrow-ringed wood from the large forest trees.

KNOTS.

The Forest Service has made a number of tests of bridge stringers, obtaining the relative strength of clear timber and timber containing knots of various kinds and location. An engineer of tests was located at the sawmill and procured 8x16 stringers, ranging all the way from almost clear and select sticks down to second grade sticks containing large knots located at unfavorable points. The work was so directed that the sticks representing various conditions of knots could be procured green, and tested before seasoning.

The account of these tests is in Circular 115 of the Forest Service. It is shown that the size of the knot in itself is not a ruling element. Small knots which are near enough to the tension face of the stick to turn off the grain are more weakening than larger knots that allow the grain to be continuous. The straightness or obliquity of the grain is an important element.

The position of the knot is, therefore, of great importance. The matter is very well shown in the table reproduced from a paper by the writer. The diagram shows the vertical face of the stringer divided into three areas, limited as shown in the diagram. Volume 1 represents the portion of the stick in tension one fourth of the height of the stringer and one fourth the length each side of the center. Volume 2 is the corresponding area of the top or compres-

TABLE 3.—*Bending strength of large sticks.*
 .LOBLOLLY PINE.

Reference number.	Locality of growth.	Dimensions.		Grade.	Condition of seasoning.	Number of tests.	Moisture per cent.	Rings per inch.	Specific gravity.	Weight per cu. ft.		Fiber strength.	Modulus of rupture.	Modulus of elasticity.	Elastic resilience.	Number falling by longitudinal shear.	Remarks.
		Section.	Span.							As tested.	Oven dry.						
1	South Carolina.	6"x 7"	10' 0" to 15' 6".	Square edge.	Green.....	Average....	{ 48.0 } { 92.1 } { 92.1 }	{ 5.7 } { 11.7 } { 2.3 }	{ .50 } { .60 } { .40 }	{ 46.2 } { 56.8 } { 35.6 }	{ 31.2 } { 37.5 } { 25.0 }	Lbs. per sq.in.	Lbs. per sq.in.	1,000 lbs. per sq.in.	{ 0.45 } { .99 } { .07 }	{ 7 }	{ Moisture above saturation point in all cases.
		6"x10"				Maximum ..											
		4"x12"				Minimum ...											
		6"x16"															
		8"x14"															
2	South Carolina.	6"x 7"	10' 0" to 16' 0".	Square edge.	Partially air dry	Average....	{ 27.7 } { 29.2 } { 25.5 }	{ 5.0 } { 8.2 } { 2.6 }	{ .50 } { .55 } { .45 }	{ 40.0 } { 43.7 } { 35.6 }	{ 31.2 } { 34.4 } { 28.1 }	Lbs. per sq.in.	Lbs. per sq.in.	1,000 lbs. per sq.in.	{ .45 } { .76 } { .20 }	{ 0 }	{ Moisture from 25 to 30 per cent.
		4"x12"				Maximum ..											
		6"x10"				Minimum ...											
		6"x16"															
		8"x16"															
3	South Carolina.	6"x 7"	10' 0" to 15' 0".	Square edge.	Partially air dry	Average....	{ 21.0 } { 24.9 } { 15.0 }	{ 5.6 } { 17.2 } { 2.7 }	{ .50 } { .58 } { .41 }	{ 37.5 } { 45.6 } { 31.2 }	{ 25.6 }	Lbs. per sq.in.	Lbs. per sq.in.	1,000 lbs. per sq.in.	{ .39 } { .69 } { .10 }	{ 2 }	{ Moisture less than 25 per cent.
		4"x12"				Maximum ..											
		6"x10"				Minimum ...											
		6"x16"															
		8"x 8"															
4	Virginia	6"x 7"	6' 0" to 16' 0".	Square edge.	Partially air dry.	Average....	{ 22.4 } { 27.7 } { 17.8 }	{ 4.8 } { 8.8 } { 2.5 }	{ .46 } { .53 } { .37 }	{ 35.6 } { 43.1 } { 30.0 }	{ 28.8 }	Lbs. per sq.in.	Lbs. per sq.in.	1,000 lbs. per sq.in.	{ .51 } { 1.05 } { .13 }	{ 0 }	{ Moisture less than 25 per cent.
		4"x12"				Maximum ..											
5	Virginia	8"x 8"	6' 0" to 15' 6".	Square edge.	Green.....	Average	{ 64.0 } { 100.5 } { 83.8 }	{ 3.0 } { 4.0 } { 2.5 }	{ .48 } { 4.0 } { 2.5 }	{ 48.7 } { 51.9 } { 35.0 }	{ 26.9 } { 31.9 } { 21.9 }	Lbs. per sq.in.	Lbs. per sq.in.	1,000 lbs. per sq.in.	{ .81 } { 1.93 } { .87 }	{ 0 }	{ Very rapid growth; poor quality.
		8"x12"				Maximum ..											

LONGLEAF PINE.

6	South Carolina.	6" x 8. 10" x 16"	15' 0"	Merchantable	Partially air dry.	Average .. Maximum. Minimum.	{ 23	{ 25.0 13.7 0.58 45.6 36.2 40.3 25.4 .76 60.0 47.5 17.3 6.2 .50 39.4 31.2	3,800 4,970 2,220	7,160 10,020 5,450	1,560 2,010 1,190	0.58 .78 .21	9
7	Georgia.....	10" x 12"	15 "	Merchantable	Partially air dry.	Average .. Maximum. Minimum.	{ 22	{ 27.3 18.0 .69 54.7 42.9 34.5 23.0 .79 49.4 20.0 11.0 .50 31.4	5,531 9,500 3,547	8,384 11,410 4,836	1,820 2,920 1,167	6

{ Excellent mer-
chantable grade.

TAMARACK.

8	Minnesota	4" x 10" 6" x 12"	13' 6" ...	Merchantable	Green.....	Average .. Maximum. Minimum.	{ 30	{ 50.6 14.0 0.48 45.2 30.1 72.1 24.4 .60 52.9 37.6 31.4 7.3 .43 39.5 26.9	2,310 3,780 1,431	4,562 6,080 2,040	1,219 1,538 797	0.82 1.02 .24	4
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NORWAY PINE.

9	Minnesota.....	4" x 10" 4" x 12" 6" x 12"	13' 6"	Merchantable	Green.....	Average .. Maximum. Minimum.	{ 49	{ 47.8 13.6 0.41 37.4 25.4 85.8 32.4 .48 45.6 33.9 29.5 6.7 .35 29.7 20.9	2,550 3,915 1,609	3,975 5,625 2,810	1,189 1,700 808	0.52 1.08 .22	7
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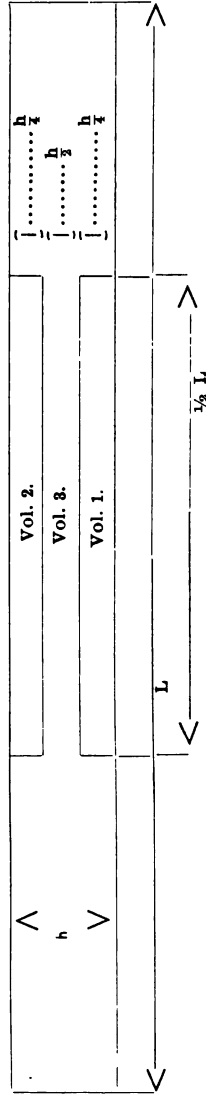
(From Circular 115, Forest Service)

TABLE 1.

EFFECT OF KNOTS UPON THE STRENGTH OF LOBLOLLY PINE AND DOUGLAS FIR. SIZE: PINE, 5" x 12"; FIR 8" x 16"; 15' SPAN.
Strengthen Functions of Groups I and II are expressed in Per Cent. of those of Group III.

Notz.—Shaded parts of Sketches Indicate Clear Portions of Beams.	Species.	No. of Tests.	Per Cent. of Sap.	Per Cent. Moisture.	Rings per Inch.	Spec. Grav. (Dry.)	Fiber Stress at Elastic Limit. Lbs. per Sq. In.	Modulus of Rupture. Lbs. per Sq. In.	Modulus of Elasticity. per Sq. In.
Group III 	L. Pine D. Fir	11 30	45 0	57 Green	6.5 13.2*	.46	3820 4619	6380 6846	1675 1710
Group II. In Per Cent. of Group III. 	L. Pine D. Fir	15 30	52 0	76 Green	6.2 12.7*	.43	78.6 93.0	78.6 95.6	82.1 92.1
Group I. In Per Cent. of Group III. 	L. Pine D. Fir	33 75	42 0	65 Green	5.6 9.6*	.49	74.1 80.4	71.7 80.2	81.5 84.1

* Approx (determined on nearly one-half the number of sticks).



Group I.—Sticks having defects in Vol. 1.
Group II.—Sticks having defects in Vol. 2 but not in Vol. 1.
Group III.—Sticks having defects in Vol. 3 but not in Vols. 1 or 2.
(From Proceedings American Railway Engineering and Maintenance of Way Association).

sion face of the stick. Volume 3 is the remainder of the stick.

The test shows that if knots occur in Volume 3 they do not determine the strength of the stick, because the strength is very nearly that of the clear, select stick. If the knots occur in Volume 2 or 3, it is likely to be in tension, and the strength of the stick would be reduced about thirty per cent.

SHAKES.

The ring shakes and deep season checks on the side of the stringers are serious defects and cause failure by splitting at the ends; that is, under horizontal shear.

SEASONING.

While it is known that the strength of a small stick, when well seasoned, may be as much as three times that of the corresponding green stick, yet this increase of strength due to seasoning is not to be expected in case of large timbers.

These latter usually develop checks or shakes under seasoning process, due to uneven drying throughout their volume. A series of tests by the Forest Service shows that by careful seasoning in the shed, the strength of select timbers can be increased by about twenty per cent., yet seasoned merchantable and second grade timber are practically no stronger than the corresponding green sticks. The conclusion is that the engineer is not justified in counting upon any strength beyond that of green timber.

EFFECT OF PRESERVATIVES.

It is usually admitted by those engaged in the business of treating timber that the strength of the latter may be seriously diminished by improper treatment. By using too high a temperature of steam the timber may become brittle. The effect of the creosoting fluid, however, is not detrimental to the wood fiber. It apparently only has the effect of retarding the seasoning process. A series of tests is

now planned by the Forest Service to determine whether or not the unit stresses used in case of natural timber should be reduced for creosoted structures. The probability is that under proper conditions of creosoting, the treated timbers may be regarded as equal in strength to the green natural sticks.

STRENGTH OF SPECIES.

All these matters are dealt with more fully in the following publications: Circular 12, Circular 15, Circular 38, Circular 39, Circular 46, Circular 108 and Circular 115.

Tables 2 and 3 are from Circular 115, Forest Service, and give relative strength of various species in large and small sizes.

President.—Prof. Hatt, on behalf of our society I want to thank you for this interesting discussion. I am sure it has been quite an education to all of us.

Mr. Reid.—I would say this subject of timber is about as vital a subject as any we have under consideration, and I would like to ask Prof. Hatt if it would be in order for him to give us some of the figures on the strength of these timbers referred to, which are to be published soon. Possibly he may not feel like giving this out in advance of the publication, but if it could be done, I think it would be a great advantage to all of us.

Prof. Hatt.—I shall be glad to do that, Mr. President.

President.—The next subject is number two, "Water Supply," Mr. C. E. Thomas of the Illinois Central, chairman.

Mr. Lichty.—We are making very good progress but we have quite a number of reports to consider yet and if we attempt to complete the list today and tomorrow before noon, together with the rest of the regular business, it is going to crowd us, and it is thought by some that perhaps it would be better to extend the sessions a little further into Thursday, and have these side trips on Friday. I would like to have the voice of the meeting in regard to this,

because it is going to crowd us a good deal to get in these side trips and finish up the reports in good shape in the time we have. I would suggest, Mr. President, that you put this to a vote.

President.—Gentlemen, what is your pleasure in regard to this matter?

Mr. Lichty.—As you understand, a trip has been arranged for 4 o'clock this afternoon to the breakwater, where they are putting in some concrete work; also a theatre party tonight, and, by the way, a luncheon will be served right after the theater party, which you all should keep in mind. It will be necessary to shorten the afternoon session a little today so as to be ready to start with the mayor to the breakwater at 4 o'clock; tomorrow we might extend the session over to the afternoon and make these side trips on Friday. If any of the members wish to take additional trips, we can arrange transportation for them to go Saturday.

Mr. A. S. Markley.—We are always short of time and it seems to me there is business that we should attend to, and it will be neglected if we make these side trips Thursday afternoon and it will also probably be dark before we return. I would rather wait until Friday morning and take the side trips then and not try to crowd too much business into our last session.

Mr. Lichty.—I would suggest that we take this trip to the breakwater this afternoon and extend the business session tomorrow, as that will give us plenty of time. I make a motion to that effect.

Mr. Staten.—I second the motion that we take this trip to the breakwater this afternoon at 4 o'clock and continue the business session as long as necessary Thursday and then make the side trips Friday.

President.—All in favor of the motion please say aye. Motion is carried unanimously.

President.—We will now proceed with the next subject,

which is number two, "Water Supply." C. E. Thomas is chairman of that committee.

(See discussion on standing subject number two, "Water Supply.")

President.—We will now take up the next subject, which will be number three, "Fire Protection." William C. Carmichael was chairman of that committee.

(See discussion on standing subject number three, "Fire Protection.")

Mr. Eggleston.—I move that we now adjourn until 2 o'clock this afternoon. Motion seconded by Mr. Large.

President. It has been regularly moved and seconded that we now adjourn until 2 o'clock this afternoon. All in favor of the motion please say aye. The motion prevails.

AFTERNOON SESSION.

WEDNESDAY, October 16, 1907.

President.—Gentlemen, you will please come to order.

President.—At the time of our adjournment this forenoon, we were considering subject number three, "Fire Protection." Has any one anything more to say on this subject? If so we would be glad to hear it.

Secretary.—Mr. President, we have just received a report on "Fire Protection," subject number three, which I would suggest that you have the assistant secretary read.

Report referred to was thereupon read by assistant secretary. (See report.)

Secretary.—Here is also another report on this subject from Mr. Shope. (See report, which was also read by assistant secretary.)

President.—Gentlemen, you have heard the reading of these reports on subject number three, "Fire Protection." What is your pleasure?

Mr. Parker.—I move they be accepted and placed in our minutes.

Motion seconded.

President.—It has been regularly moved and seconded that these reports we have just read on the subject of "Fire Protection" be received and placed in our minutes. All in favor of that motion please say aye. Motion prevails.

President.—Has anyone anything more to say on this subject of "Fire Protection?" If not, we will pass to the next subject, which is subject number four, "Fences, Road Crossings and Cattle Guards," Mr. W. M. Noon, chairman. Two of that committee are here at this time I believe, but if nothing is to be said on this subject we will pass it and proceed with the next one.

(No discussion on subject number four, "Fences, Road Crossings and Cattle Guards.")

President.—We are now ready to take up subject number five, "Preservatives for Wood and Metal," Mr. W. F. Parker of the Southern California Railway, San Bernardino, Cal., chairman.

(See discussion on subject number five, "Preservatives for Wood and Metal.")

President.—If there is nothing more on this subject, "Preservatives for Wood and Metals," we will now be obliged to adjourn on account of the trip to the break-water with the mayor.

Mr. Riney.—I move we now adjourn until 9 o'clock in the morning.

President.—All who favor this adjournment, please signify by saying aye. Motion prevailed.

MORNING SESSION.

THURSDAY, October 17, 1907.

President.—Gentlemen, you will now please come to order, and we will have to work fast, as we have considerable routine work yet before us. In the absence of our Assistant Secretary, Mr. Arthur Montzheimer, who has been unexpectedly called home, I will appoint Mr. J. P. Canty to act in his stead as Assistant Secretary for the remainder of our sessions.

President.—A member from the Reading Road, Mr. Storek, brought a blue print with him of an insulated rail joint. Any one who is interested in it will find the plan referred to on the table. I have promised to make this announcement for him. I have therefore done my part.

President.—Our standing subject number five, "Preservatives for Wood and Metal," which we discussed yesterday afternoon, is very important to us all. Has anybody anything more to say on that line?

Mr. A. S. Markley.—No one seems to have anything more to say in reference to that subject, but I think that is a subject which ought to be one of our continuous subjects. With the new developments coming up each year for the preservation of timber, we will all be interested in knowing just what developments take place during the year, and I favor the idea of keeping this subject open so we may keep in touch with it in that way; I merely make this as a suggestion.

President.—Do you make this a motion?

Mr. A. S. Markley.—No, sir, but I will make that as a motion.

Motion seconded.

President.—It has been regularly moved and seconded that subject number five be continued as one of our standing subjects. All in favor of that motion please say aye; contrary, no. Motion prevails.

President.—We have finished the reports of last year and we will now commence on the discussion of the reports written up for this year. The first is number one, "Experience in Concrete Bridges, Arches and Subways," W. H. Finley, chairman. We have no report on this subject.

Mr. Lichty.—I will just state that Mr. Finley will probably present that report himself. He will be here some time today.

Mr. Lichty.—Before going on with the other reports, if there is no objection I would like to read the reports on subjects number five and six, inasmuch as they did not come

out in the advanced copies of reports printed by the Association. They are, however, now printed and are here. Mr. President, if you will allow us to take these up first, I will read them, as they are short.

President.—I think there will be no objection to this and you may read them.

(Report on subject number five, "Recent Experience in the Use of Wooden and Asbestos Smoke Jacks for Engine Houses," was thereupon read by Mr. Lichty. See report.)

Mr. Lichty.—I would now like to read subject number six.

(Report on subject number six, "Combination Fastening and Lock for Rolling and Sliding Doors on Freight Houses and Other Buildings," was read by Mr. Lichty. See report.)

Mr. Lichty.—These copies can be distributed before discussion, as they are now on hand. They were not received in time to be sent out as advanced copies before the Convention.

President.—We will talk first on report number six, "Combination Fastening and Lock for Rolling and Sliding Doors on Freight Houses and Other Buildings." This is a very important subject, as those of you who heard Mr. Aishton speak will realize what it means. I believe, however, it will be better for us to take up subject number five first.

(See discussion on subject number five, "Recent Experience in the Use of Wooden and Asbestos Smoke Jacks for Engine Houses.")

Mr. W. O. Eggleston.—I move this subject number five in regard to smoke jacks for round houses be continued one more year for further developments.

Mr. Clark.—Second the motion.

President.—It has been regularly moved and seconded that subject number five be continued to our next year's standing subjects. All in favor of that motion please say aye. The motion is carried unanimously.

President.—The next subject is number six, "Combination Fastening and Lock for Rolling and Sliding Doors on Freight Houses and Other Buildings." This is a subject which is more or less important to us all. It is not an uncommon thing to send a man out and have to charge up a whole day's time to do only fifteen minutes' work to repair a lock. Has anyone anything to say on this subject? If not, we will pass it and proceed to the next subject, which is number seven.

(No discussion on subject number six.)

President.—We are now ready to take up subject number seven, "Construction of Towers and Guides for Lights on Draw Bridges." The committee consists of John N. Penwell, chairman, Floyd Ingram, Geo. W. Rear and G. J. Klumpp. If there is here anyone who would like to say something on the subject, we will be glad to hear it.

(See discussion on subject number seven, "Construction of Towers and Guides for Lights on Draw Bridges.")

President.—We will now take up the next subject, which is number eight, "Recent Experience in Protecting Steel Railroad Bridges Against the Action of Salt Brine from Refrigerator Cars," R. P. Mills, chairman. Mr. Montzheimer is also a member of that committee, but he is not here now.

Mr. Lichty stated he had been requested to announce that a local photographer wished to take a picture of the Convention in front of the postoffice at 12 o'clock, and that one of the supply men would furnish each person one of the photographs free, provided he was permitted to place their advertisement on the back of the photo.

Mr. Reid.—I move that we show our appreciation of the courtesy of our friend in accepting this offer and that we go to the post office and have the pictures taken as requested.

Mr. Killam.—I second the motion.

Motion carried.

President.—Gentlemen, we are now ready to discuss subject number eight.

(See discussion on subject number eight, "Recent Experience in Protecting Steel Railroad Bridges Against the Action of Salt Brine from Refrigerator Cars.")

President.—As we have promised to go to the post office to have a picture taken, a motion to adjourn will now be in order.

Mr. Large.—I move that we now adjourn until 2 o'clock this afternoon.

Mr. Staten.—I second that motion.

Adjournment was then taken until afternoon session.

AFTERNOON SESSION.

THURSDAY, October 17, 1907.

President.—Gentlemen, the time is getting short and you will please come to order, as we will have to get to work on these subjects that we are to talk on. You understand, of course, they will all come up a year from now, so that it does not make any material difference if we do not get through with them. The next subject to be taken up will be subject number one, "Experience in Concrete Bridges, Arches and Subways." Has anyone anything to say? If not, we will pass subject number one and take up the next subject.

(No discussion on subject number one, "Experience in Concrete Bridges, Arches and Subways.")

President.—We are now ready to take up the next subject, number two, "Concrete Building Construction," Mr. A. O. Cunningham of the Wabash, chairman. Has any one anything to say on this subject number two? It appears we are to have no discussion on this subject and we will proceed and take up the next subject, number three, "Experience as to Expansion and Contraction of Concrete Walls, Either Reinforced or Plain Concrete," Mr. A. S. Markley, chairman.

President.—For the benefit of the members who have just come in I will state the subject again, "Experience as to

Expansion and Contraction of Concrete Walls, Either Reinforced or Plain Concrete." Has anyone anything to say on this subject?

(See discussion on subject number three.)

President.—We are now ready to take up the next and last subject for discussion this year, which is subject number four, "Action of Sea Water on Concrete," Mr. G. Aldrich, chairman. We are now ready for discussion of this report.

(See discussion on subject number four, "Action of Sea Water on Concrete.")

President.—The next in order will be report of Committee on Selection of Subjects for Reports and Discussions. Mr. Schall is chairman of that committee and we will now hear from him.

Secretary Patterson.—I will state, Mr. President, that we have that report here on the desk and the assistant secretary will read it.

REPORT OF COMMITTEE ON SELECTION OF SUBJECTS.

MILWAUKEE, WIS., October 16, 1907.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on the selection of subjects for next year's work presents the following report:

SPECIAL SUBJECTS.

Number one. Waterproofing of concrete covered steel floors and subways.

Number two. Modern equipment and tools for erection of steel bridges.

Number three. Protection of structures against the effects of electric currents.

Number four. Protection of embankments from the effects of high water by rip-rap or otherwise.

Number five. Experience in the use of gasoline engines and kerosene engines or combination of same for water supply, draw bridges, etc.

Number six. Modern dwelling houses for section foremen and section men in outlying districts.

Number seven. Reinforced concrete culverts and short span bridges.

Number eight. Methods of erecting truss bridges.

a. Maintaining traffic.

b. No traffic.

STANDING SUBJECTS.

- Number one. Pile and frame trestle bridges.
- Number two. Fire protection.
- Number three. Fences, road crossings and cattle guards.
- Number four. Construction of cofferdams.
- Number five. Preservation of timber.
- Number six. Coaling station and cinder pits.

F. E. SCHALL,
W. M. CLARK,
Committee.

Mr. Killam.—I move the adoption of this report.

Mr. Large.—I second the motion.

Motion carried.

President.—The next will be the Obituary Committee report.

Assistant Secretary thereupon read the report of the Obituary Committee.

REPORT OF OBITUARY COMMITTEE.

MILWAUKEE, WIS., October 17, 1907.

To the Officers and Members of the Association of Railway Superintendents of Bridges and Buildings:

During the last year it has pleased the will of God to remove from our number three of the respected members of our Association, thus reminding us of the uncertainty of life, the certainty of death and the importance of well living and the preparations for death; therefore be it

Resolved, That we as an Association deeply and sincerely mourn the loss of these beloved Brothers: W. H. Keen, J. W. McCormack and Thomas Humphrey.

Resolved, That the sympathy of this Association be tendered to the widows and families of the deceased Brothers by the Secretary, and that a copy of these resolutions be printed in our proceedings; also a copy be forwarded to the respective families of these deceased Brothers.

J. N. PENWELL,
Committee.

Mr. O'Neil.—I move the adoption of the report.

Mr. A. S. Markley.—I second that motion.

Motion carried.

Mr. A. S. Markley.—Mr. President, I wish to state, if it is now in order, that we have with us a member from the Chicago & Northwestern Road, Mr. H. P. Morrill of Madi-

son, Wis., who has been retired, and I move that he be placed among our life members.

Mr. Clark.—I second that motion.

President.—Gentlemen, you have heard the motion. All in favor of same will please say aye. The motion prevails.

Mr. A. S. Markley.—One word more, Mr. President. I think these dates should be kept when our members are retired from active service, or when they die, etc., in our Proceedings.

Secretary Patterson.—Mr. President, in connection with that proposition I will say that I sometimes have difficulty in ascertaining the dates of the deaths of our members. I have letters which I have sent to the widows which have been returned to me unopened. It is very difficult to obtain that data, and several times letters of condolence and resolutions which have been passed by the Association have been mailed to the widows and these letters come back to me.

Mr. W. O. Eggleston.—There is another member who is practically out of service and one whom we all love and respect, and I move you, sir, that Mr. C. W. Vandegrift be placed on the roll of life membership.

Mr. Riney.—I second that motion.

President.—It has been regularly moved and seconded that Mr. Vandegrift's name be placed on the life roll. All in favor of this motion please say aye. Motion prevails.

Secretary Patterson.—I would like to ask the Assistant Secretary to read a letter which I have received from Mr. Joe Cummin. (Cheers.)

BAY SHORE, N. Y., October 14, 1907.

Mr. S. F. Patterson, Secretary, and Members of the Association of Railway Superintendents of Bridges and Buildings:

It is with sincere regret that I have to write that I will be unable to be with you at the meeting of the Association, but I can assure you that during the coming week my mind will wander many times toward Milwaukee and I shall never forget the many pleasant reunions I have had with the members of our Association. It is composed of the best, biggest-hearted and most loyal body of men that it has ever been my good fortune to be associated with,

and I earnestly hope that the good work it has done, and is still engaged in, will go on improving more and more as the years go by, until it will be recognized by railroad officials throughout the country as one of their best assets and receive the encouragement that it certainly deserves. When I think of the many warm friends I have made among the members, and realize that it may be that I shall never meet them again, words fail me, to express myself as I would wish; but I can assure you that I shall never forget the many acts of kindness and words of cheer that I have received from the boys, and I may say the ladies also, who form so strong an auxiliary to the members. If you should happen to meet in this section of the country at any future time, I will use my best efforts to be with you. I would have liked very much to have been with you at this meeting, in order to say good-bye personally, but it was impossible. Kindly remember Mrs. Cummin and me to all, and with the best wishes for the success of the Association and that you may have a profitable meeting, believe me to be

Sincerely yours,

J. H. CUMMIN.

Mr. Killam.—It is with great pleasure that I move that the name of Joseph H. Cummin be placed on the list of life membership.

W. O. Eggleston.—I will second the motion that Mr. Cummin be placed on the life membership roll.

President.—Gentlemen, you have heard the motion. All in favor of the motion, please say aye. Motion is carried.

Mr. H. P. Morrill.—Brother members, I thank you very much, one and all, for the honor you have conferred upon me.

A large number of letters were received by the Secretary, expressing regrets that they were unable to be present at this Convention.

Secretary Patterson.—I believe there is a little notice in one of the technical papers in regard to one of the applicants whom we voted in yesterday. I suppose it would not be wise or proper to make a memorial for him, because we have not known him and he was practically not a member, as he died before we acted upon his application. I propose to return his membership fee to his family, with a letter of condolence.

President.—The next is a report of the Committee on Resolutions.

President.—Mr. R. H. Reid was made chairman and Mr. H. Rettinghouse and Charles Carr were on that committee.

Mr. Reid.—If I was on that committee I had not heard of it and I do not know whether either of the other members have made any report or not.

Mr. Rettinghouse.—I was entirely ignorant of the fact that I was a member of that committee.

Secretary Patterson.—Mr. President, perhaps these gentlemen were not present at the time you made your appointments.

Mr. Reid.—I would suggest that this matter be allowed to lay over until our evening session, and we will endeavor to have a report ready by that time.

Mr. Perry.—I make a motion that Secretary Patterson write to Mr. Joseph Cummin and that he express in his letter the respect which has been shown towards him in this meeting, in answer to his letter to us.

Mr. Staten.—I second that motion.

President.—It has been regularly moved and seconded that the Secretary be instructed to write such a letter as only the "Deacon" can write, and all who are in favor of this motion will please say aye. Motion carried.

President.—I would suggest that the "Deacon" also include the other two men who have been made life members.

President.—The next is new business. Under this head the nominations for the next place of meeting will be in order.

Mr. Clark.—I nominate Washington, D. C.

Mr. A. S. Markley.—I will place the nomination Toronto, Canada.

Mr. Riney.—I nominate Indianapolis.

The President read a letter from the Promotion Club of Peoria, Ill., requesting the Convention to hold their next annual meeting in that city.

Secretary Patterson.—I have received letters of invitation from Niagara Falls, Columbus, O., Asbury Park, New York City and Atlantic City.

Mr. Storck and Mr. Aldrich were appointed tellers to count the ballots.

President.—Gentlemen, the result of the first ballot is as follows: Washington 25, Toronto 15, Indianapolis 12, and no choice. It will therefore be necessary to take another ballot.

President.—Gentlemen, the result of the second ballot is as follows: Washington 28, Toronto 14. I therefore declare the next place of meeting to be Washington, D. C.

Mr. A. S. Markley.—I move that if the Executive Committee find it impracticable to meet at Washington, D. C., that they have the power to change the meeting place to Toronto, Canada.

Mr. Killam.—I second the motion.

Motion carried.

President.—We will now listen to the nominations for officers, which are as follows:

President, R. H. Reid; first vice-president, J. P. Canty; second vice-president, H. Rettinghouse; third vice-president, F. E. Schall; fourth vice-president, W. O. Eggleston; secretary, S. F. Patterson; treasurer, C. P. Austin; executive members, A. E. Killam, J. S. Lemond, C. W. Richey, Thomas S. Leake, W. H. Finley, John N. Penwell.

Mr. A. S. Markley.—I move that the Assistant Secretary cast one ballot for all of the officers recommended by the Nominating Committee.

Motion seconded and carried.

Assistant Secretary thereupon cast one ballot as directed.

President.—The Assistant Secretary having complied with the motion, I declare these officers duly elected to the offices for which they have been nominated.

President.—In retiring from the presidency of your Association, to which you so kindly elected me one year ago, I would say that I have made every effort to fill the requirements imposed upon me and to the best interest of the Association. I can, however, look back and see where I could

have made some improvements. As my administration is now a matter of record, these mistakes—if mistakes they are—might be a lesson to my successor.

I wish to thank the members of this 17th annual Convention for their strict attendance and the interest they have shown at all of the meetings.

In introducing my successor to you, I only hope that you will extend the same kindly feeling towards him during his term as President as you so kindly done to me. I take great pleasure in introducing to you Mr. R. H. Reid, our next President. Mr. Reid, will you kindly step forward and assume the duties of your office?

Mr. Reid.—Members and Friends of this Association: I cannot say that this call is sudden or unexpected, for the reason that some time ago when the question of the nomination and election of a President was under consideration, it was deemed best to promote the presidents in the way of the vice-presidency, and when I accepted the office of vice-president, it was understood that in time, if the Association considered it advisable, I would be willing to accept the office of President, and the Association has so expressed its will; and while I do not court the duty it requires, I appreciate the honor, but with the honor comes the responsibility of certain work and of doing my share towards making a success of the Association. But no president alone can make a success of any association; it is the members themselves who make it successful. In giving out their views, opinions and their knowledge at these meetings in the discussions, they not only benefit themselves but benefit the Association as a whole, as well as the companies which we represent, and I wish for the assistance of the members all the way through my administration. I shall depend upon each one to do his share. One of the important questions is the committee nominations. I am unable at the present time to announce the names of the members who will be asked to form the committees, but I wish

to request each of you at this time to kindly take the part assigned to you, to take your share of the committee work as well as the general work of the Association. In addition to that, I would like it very much if there is any special subject which has been proposed for discussion next year, if you will kindly advise me on which one of the committees you would be willing to serve if requested; I shall certainly be very glad to hear from you. A great many of the members I do not know by sight or name and of some of those whom I have met I am unacquainted with the special kind of work which they represent. There may be a great many especially qualified along certain lines of work who can give us the benefit of their knowledge in the committee reports, and as I said before, I would be very glad to hear from all of you on that line. I do not think I can say anything more now, but there is one suggestion I am going to make and that is that in the discussions in the meetings I would like to have each member who rises to speak give his name as well as the name of the road he represents, so that the members may become familiar with each one here. There are a good many of us who do not know the names of all the members and in this way in time we will learn the names and the location of each member. The reason for the request is this, certain work in certain locations has one significance and certain kinds of work in another location might have another significance. I do not know anything further to say at present. I thank you. (Applause.)

The President then called on the members elected to the different offices and requested each to assume the office to which he was elected. All those present accepted the offices to which they were elected.

President.—This, I believe, concludes the nomination and election of officers.

Mr. Storck.—I move that we extend a vote of thanks to Mr. J. H. Markley, our retiring President, for his efficient administration of the duties of his office.

Motion seconded and carried.

Secretary Patterson.—I would like to impress upon the members the importance of sending in their reports early.

President.—It will be necessary to hold a short session this evening and I would respectfully request that you kindly be here at 7.30 this evening for a short time.

Adjourned.

EVENING SESSION.

THURSDAY, October 17, 1907.

President.—The meeting will please come to order. The first in the order of business is the report of the Committee on Resolutions. I will ask the chairman of that committee to read the report, or rather Mr. Rettinghouse.

Report of Committee on Resolutions was thereupon read by Mr. Rettinghouse.

REPORT OF COMMITTEE ON RESOLUTIONS.

MILWAUKEE, Wis., Oct. 17, 1907.

Your Committee on Resolutions respectfully submit the following:

Resolved. That the thanks of this Association be extended the railroads, Pullman and other companies, individually and collectively, for their courtesies tendered us in connection with our Seventeenth Annual Convention;

To the C. & N. W. Ry., and C., M. & St. P. Ry. for providing special trains and side trips to the industrial establishments near by;

To Mayor Becker and General Manager R. H. Aishton of the C. & N. W. Ry. for their very able and instructive addresses.

To Prof. Hatt of Purdue University for his very instructive address on "Strength of Various Kinds of Timber;"

To W. H. Finley, assistant chief engineer, C. & N. W. Ry., for his interesting description of the Quebec disaster;

To the Republican House for their kind treatment of all attending our Convention;

To the various industrial plants for their courtesies and hospitable treatment;

To the Milwaukee daily papers and the various technical journals for reports of the meeting of the Convention;

To the Supply Men's Association and the different supply houses who made exhibits at the Convention and assisted in such generous manner in the entertainment of the members and their families;

Also to the Business Men's League, and the Citizens' Business League, R. B. Watrous, Secretary, for courtesies extended.

R. H. REID,

H. RETTINGHOUSE,

Committee.

President.—You have heard the report, what is your wish in regard to it?

Mr. A. S. Markley.—I move that the report be received and printed in our Proceedings.

Motion seconded and carried.

Mr. Rettinghouse.—As has been the custom for years, during our conventions, or rather at the close of our conventions, to show by a slight token our appreciation of the service rendered by the Committee on Arrangements, we have this year followed the same custom, and I also believe you will agree with me that this year the committee has certainly excelled in that direction. It has been my good fortune to be rather intimately acquainted with the two gentlemen on this committee and when it came to the selection of a suitable present, I fortunately remembered the different tastes of the two members. They are very much in the direction of good living. I was located at one time in the same town with Brother Lichty and made it a custom to very often break bread with his family, and by the way, Mrs. Lichty is a very good cook; for that reason I always liked to visit them about the time a meal was ready and I found that while she provided generously enough at each meal that she did not have a table large enough, so we present a dining room table to Mr. Lichty and his wife. Mr. Riney, who is situated a little farther West, has different tastes. He is farther removed from Milwaukee and it is very hard for him to obtain the amber fluid, so has to drink water; for that reason, we have provided him with a set of glass ware, so that he can drink water to his heart's content. On behalf of the members of this Association, I thank you, gentlemen, for the very able manner in which you have fulfilled your task. (Applause.)

Mr. Riney.—Brother Members, Chairman and Ladies: For what I have been able to do I did not expect any recompense, for my services were very light. I do not feel that I am deserving of anything of this kind and I would

have been more pleased to have performed my duty without receiving this gift, but I thank you very much.

Mr. Lichty.—Ladies and Gentlemen: I did not expect anything like this. I have been a member of this Association a good many years. I have heard a good many people make a little speech on occasions like this and I have seen some of them shed tears. I don't know what I can say to thank you. I do love the members of this Association, I can say that much, and I only wish I had a few words I could say that would express what I wish to say for this splendid gift, which I sincerely appreciate and for which I thank you all. (Applause.)

Mr. A. S. Markley.—Mr. President, I believe there is no further business to come before this Convention and I move that we now adjourn to meet in Washington, D. C., on the third Tuesday in October, 1908.

Secretary Patterson.—Second the motion.

President.—It has been regularly moved and seconded that we adjourn to meet at Washington, D. C., provided we can complete arrangements that are satisfactory for meeting there. All those in favor of that motion, please say aye; those opposed, nay. The motion prevails and we now stand adjourned, and I hope to meet you all in Washington.

S. F. PATTERSON,

Secretary.

W. C. KIKENDALL,

Official Stenographer.

DISCUSSION OF COMMITTEE REPORTS FOR 1905-1906

CONTINUED FROM THE FIFTEENTH ANNUAL
CONVENTION.

Subjects number one, two and three passed without discussion, as follows:

I.

CONCRETE BRIDGES, ARCHES AND SUBWAYS.

II.

EXPERIENCE AND USE OF CONCRETE AND
TIMBER PILES.

III.

CONCRETE BUILDING AND CONSTRUCTION.

IV.

BEST METHODS OF WATERING STOCK IN TRANSIT.

Mr. Penwell.—Mr. President, a full report on this subject was made at our convention in Boston last year, and it went into the details as to the best methods of watering stock in transit; and I will say for the benefit of those who have just become members, that in last year's proceedings we had cuts, made from a number of blue prints, showing the Clover Leaf, Boston & Maine, New York Central, Lake Erie & Western and others (I forget just what roads they were), showing their methods for watering stock. The report did not touch upon the duties of the railroad company in regard to the watering of stock, because that is covered by law, but it was in regard to the best method to adopt to carry out the instructions of the law. The blue prints were all published in the report and information can be had from that report. If there is anything new on the subject I would like to hear it. I received a number of letters from western people, stating it did not concern them, that it was not a requirement, and in the East, where I expected they did a great deal of watering stock, they also stated they were not required to provide for it. It seemed to apply more to the middle states. I think ninety per cent. of the replies we received were from roads in the middle states and it is a subject of vital importance to these railroads. This report covers the devise of sprinkling hogs in the cars as well as watering them, and I think perhaps the best method reported upon was that of the New York Central and the Lake Erie and Western roads. I think the New

York Central has the best method and forms a better spray, but it is more elaborate and costs more money.

President.—It appears to me that the title of the subject is not explicit enough. The best method of watering stock in transit might mean merely a sprinkling system to cool them, but that is not on the inside, it is on the outside. What is meant by this, cooling them down or providing water in the cars for them to drink?

Mr. Penwell.—The report is intended to cover both systems.

Mr. Upp.—Our experience in watering of stock from water tanks while in transit has been very unsatisfactory, having to depend upon train men to do the work and having no provision made whereby this can be accomplished except by opening the tank valve, thus giving the stock water while the train is moving slowly by the water tank. Usually stock watered by this method receives either too much or too little water, sometimes resulting in loss of stock, especially hogs. I am equipping our water station with a two-inch hose to use for this purpose. I think that this will be a more satisfactory and economical method.

President.—I have for the last twenty years attached a hose to our water tanks, a two-inch hose, and then used a piece of one and one-half inch gas pipe flattened, leaving a flat opening in the end to make a good spray, and I have found this method very satisfactory.

Mr. Penwell.—We adopted that plan some time ago but our trouble was in getting the train men to take care of the hose. The agent could do it, but generally is busy and does not. We erected little stand pipes such as referred to. We had in view in erecting these little stand pipes a saving of the water on account of there being so many places where we have to buy water from the city, and in flushing from the goose neck, it wastes too much water. With these stand pipes that I speak of, we have a small stream of water or a spray and the result is a very great saving on our water bills. We have never had any trouble with killing hogs in

the car, as the gentleman speaks of, since adopting the spraying method. Even if they should become hot after loading them, we spray them, and in my opinion it is a very satisfactory method and at the same time very economical.

President.—In answer to Mr. Penwell in regard to taking proper care of the hose, invariably my pumpers take care of the hose. We buy cheap, two-ply hose, and sometimes it lasts two and three years. I must say, however, that I have a very good class of men, who look after these things and who take a personal interest in them.

Mr. Clark.—We are using rather a cheap arrangement for drenching cattle or hogs in transit, which consists of a two-inch pipe beside the track, which comes up somewhat like a standpipe, to a height of about seven feet and we have a little platform built there so that the trainman who is to manipulate them can stand on this platform and do the sprinkling. It is made so as to throw a flat spray and is controlled by a valve which is within easy reach of the person using it; and we can spray the upper deck or any part of the car that we wish. We have no hose but have been using this arrangement for three or four years with very good success. The whole thing can be put up at water stations at a cost of less than \$50.

Mr. Carr.—Does it become absolutely necessary that stock in transit should be watered? Is there a law that governs the shipping of cattle and hogs in relation to that?

President.—In Illinois there is a law.

Mr. Carr.—I understood that there was a law to that effect. However, it is true they are not liable to suffer so long as the train is kept in motion, but if allowed to stand a little time, in yards along the line, it is quite necessary that they be cooled off in some manner, either by sprinkling or otherwise, and on our line a great many shippers have found it very advantageous when hogs are loaded to place a few chunks of ice in the car and it keeps them in much better condition. So far as sprinkling hogs in transit is concerned, it is a very simple matter. There is a stand pipe

made by the Smith-Bale Company—I believe they were the originators of it—for sprinkling the upper or lower deck by the train hands, but if ice is placed in the car with the hogs, it will keep them in fine condition for a number of miles.

Mr. Penwell.—Referring to our president's remarks about caring for the hose, something depends upon the size of the road. We have two little branch roads with few trains, and one pumper runs two and in two cases three water tanks. It could not be expected that one pumper would care for the hose where he has so many tanks. He only makes three trips a week to his water tank and could hardly be expected to take care of that equipment. I would like to call the new members' attention to the cuts shown in last year's proceedings, especially of the Chicago & Northwestern road. They have a very good system for sprinkling and one I can recommend.

Mr. Joslin.—The question of wetting down hogs from the goose neck or stand pipe is altogether wrong. It wastes too much water and wets the hogs too much. I have seen cars running along with two or three inches of water in them, where they have opened up stand pipes. It is very wasteful of the water and there is perhaps ten times as much wasted as need go on the hogs. I think hogs ought to be wet down, but not to the extent where it is liable to kill them, and I do not think that the train men should be permitted to open up the valves on a tank and drench the hogs.

Mr. Clark.—In reference to the matter of watering stock, I think where it is necessary to give the stock water to drink that it is necessary to unload them, and do not believe it can be done otherwise to advantage. Now on our line, after the stock leaves Chicago, if there is no interruption of the traffic, they are run to Pittsburgh, where there are ample facilities to unload, feed and water them; then they can be put aboard again and go on to their destination. Almost every trunk line has those facilities at certain distances. It is just as necessary for the cattle in hot

weather to be sprinkled as it is to water them, and if it is not done the stock will die. We are now contemplating putting up small pens to hold three or four cars of stock, at our different terminals, so that in case we have delays or an interruption of traffic, the stock can be unloaded at these terminals and fed and watered.

President.—I have not had any experience with the stand pipe method, but I would not exchange the hose for all the stand pipes I have ever seen.

Mr. W. O. Eggleston.—How do you sprinkle the double decks?

President.—We have no double decks.

Mr. Penwell.—In way of explanation, in regard to the stand pipe recommended, you can raise it and lower it, or swing it to one side, or adjust it any way you desire, and can sprinkle at any angle.

Mr. Carr.—Do you refer to that used for watering engines?

Mr. Penwell.—No, sir, it is a two-inch stand pipe.

Mr. Staten.—The best way is to have pens at a certain distance that will hold some four or five cars of stock, so that the stock can be unloaded and fed and watered. In my opinion, that is the only way to give them a good drink.

President.—Is there anything more to be said on this subject? If not, we will pass it.

V.

RECENT PRACTICE IN COFFERDAM WORK.

Mr. A. S. Markley.—The president has had some experience in this line, and we might hear from him. If he has any objections to speaking from the chair, I suggest that some one take it for him.

President.—I will say that I have had some very interesting and profitable experience in this connection in the past two years in renewing three new piers under our Illinois River bridge at Peoria, Ill. I commenced this work on the 15th of October, two years ago. The first pier we put in was at the east end of a 287-foot draw bridge. At one time the old pier was in danger of being washed out. To prevent this, about twenty carloads of rip-rap stone were put in. In size, these stones were about what two men could handle. You can imagine what a job it would be to drive any kind of piling through a mess of this kind. I made the dam very large in order to get outside as much as possible, of the rip-rap stone, but fully one-half of our staves rested on them. This served as a perfect filter under them, and all the pumps we had would lower the water but ten inches. The next move we made was to put twenty-five carloads of clay on the inside of the dam and then drove another dam as small as was feasible, and then jetted the clay that lay between the two dams down in around the rip-rap stone in order to fill up the voids. This proved a great benefit, but our troubles were many before we finished; for instance, whenever we pulled a stone out from under the stave, a big leak would surely follow. It was then necessary to drive the stave that rested on the stone just removed until it struck another one. This course was followed up in this way until we reached foundation. I used what is called Wakefield Sheet Piling, made

of 3 by 12 pine, 3 ply, 24 feet long, bolted together with $\frac{1}{2}$ -inch bolts every three feet. Inasmuch as this subject is to be continued next year, I will not go any further into the matter at this time.

Mr. A. S. Markley.—How did you drive the Wakefield sheathe piling?

President.—With a seven hundred pound hammer. The leads of the driver were suspended from the ends of the derrick boom and we swung it around wherever we wished to drive. The leads were only about twelve feet long.

Mr. Penwell.—I would like to say something about the same subject the president is talking about. I visited that particular job a number of times while it was under way and I must say there has been the least said about this particular piece of work of any work of equal importance in this country. You can imagine putting down a cofferdam in a lot of rock which had been thrown in there twenty-five or thirty years before. You will probably have some idea of what our president had to contend with. I visited this work at one time when he was trying to work through this old stone, and it must be said to his credit and of the road he represents that this piece of work was performed without any accident; so far as I have ever heard; and it was one of the most successful pieces of work of that nature I have ever witnessed. There were times when I felt our president would become discouraged and start a new cofferdam, but he did accomplish his undertaking and the new pier is completed, and I must say it is a credit to him as a superintendent of bridges.

Mr. Reid.—What distance from the bottom of the rail to the bottom of the foundation was it?

President.—Forty-one feet.

Mr. Reid.—We have recently put in a couple of cofferdams at Indiana Harbor, twenty miles east of Chicago, on our line, for building abutments for new drawbridges. We drove thirty six-foot sheathe piling and drove down about thirty-two feet below the lake level. We expect to start

the driving of the foundation piles in a couple of weeks. We used a water jet and a three thousand pound hammer in driving the sheathe piling and it is standing satisfactorily.

President.—Is there anything more to be said on this subject? If not, we will proceed to the next subject.

VI.

MODERN COALING STATIONS AND CINDER PITS.

(No discussion.)

VII.

CONSTRUCTION OF BUMPING POSTS FOR PASSENGER AND FREIGHT CARS.

Mr. Reid.—This question of bumping posts was discussed pretty thoroughly last year. Since then, however, I have had occasion to notice a good many bumping posts at our different terminal points, both the Gibraltar and Ellis, and nearly all of them are knocked out sooner or later, many of them sooner. It is very seldom that a good pile bumping post can be knocked out, where good white oak piles are used and driven in firmly and properly braced. I believe they will stand the concussion of any ordinary car that is built and if there is anything wrecked it will be the car. I think the best plan is to put in a good pile bumping post rather than a patent bumping post.

Mr. Penwell.—We use pile bumping posts almost altogether and find them very satisfactory. In some places, however, we have been compelled to use the patent bumping posts, but I never yet found a bumping post that would resist the impact on the Lake Erie and Western roads. Both the Gibraltar and Ellis have been demolished a number of times on our road, and the pile posts have been damaged to such an extent that we were unable to repair them, and we were compelled to saw them off and replace them with a patent bumping post. I might tell you of the experience of one of our superintendents on a southern road, where there were a number of spur tracks running down to the bay, and about twice a month the wrecker had to be sent there to pick cars out of the bay. It was decided to do away with the bumping posts entirely and to place three planks on the rails. This was tried on some ten or twelve tracks running down to the bay by removing all the bump-

ing posts and putting down the three-inch plank and issuing a circular, stating how many cars each track would hold, and nearly a year and a half after they discarded bumping posts had never been called upon to take a car out of the bay since that time. They depended upon them, but after they were taken out they had no further trouble. There are other places where I think it is a waste of money to use bumping posts.

Mr. Killam.—I believe last year as chairman of that committee that I secured all the information it was possible to get at that time from the various members of this association and their opinions on bumping posts, which were in the proceedings printed last year. I do not know, Mr. President, that there is anything more that can be added to that report. We have different kinds of posts and have in use a good many of the Ellis bumping posts at our terminal stations, such as St. John, Halifax, etc. A good many of them are fitted up with a spiral spring, and when a car strikes it, it deadens the blow, or rather the car rebounds, and no damage is done. I do not believe we have had two broken bumping posts of the Ellis type during the last year on the whole system of our road. In some places we use simply a pile of earth, which is the very best bumper, if it is large enough to run against. They may get the cars off the track, but will not cause much damage. However, I cannot say anything additional in reference to what information was secured last year. Both the Ellis post and the Gibraltar were recommended by your committee, but the Ellis post has done excellent service and has been improved very much by being fitted up with the spiral springs in the head block, as that serves to deaden the blow.

Mr. McNab.—We formerly used nothing but pile bumping posts, driving three piles in back row and two in front, bolting timber between them and in front of them for draw bar to strike against, but we have discarded the pile bumping post entirely, as we find that they are not proof against the impact of the rolling stock that is in use today. On

nearly all our important spur tracks we use Ellis bumping posts, which give very good satisfaction, but on our less important spurs we use nothing but a pile of earth.

Mr. Hubbard.—I have used a number of pile bumping posts, but most of them rotted off inside of eight years, and the others driven were broken. These piles as used were about twenty-five feet long and driven in the ground to a depth of twenty feet or more and they were eighteen inches in diameter. I have seen them broken completely off. That is, two in front and one at the back with a piece 14x14 in between. We have also used the Gibraltar bumper, but I would not say much about that or the Ellis, which we have used in our passenger stations and those have given very good satisfaction, but where used in the freight yards they did not give good satisfaction out there. I have taken them out, also removed the pile bumpers and put in frame bumping posts of our own make, in regard to which I have previously reported, as you will see from last year's report. Those I have used for many years and some of them have now been in use fourteen or fifteen years and they are still in the ground and have never been broken. Never had but one broken and that was where they had a train of twenty or thirty cars to strike it when going at a rate of about 15 miles per hour. I have on my division about 200 bumpers and we have very little replacing to do with those of our own make.

A. S. Markley.—We commenced using the Ellis bumping post some years ago, but recently have been using the Gibraltar. The first named in my judgment is most economical to install and to maintain. When it is destroyed or damaged it can be repaired in the field at less expense and more material is received with the bumper, making less for the railroad to furnish in installing in the case of the Gibraltar. The latter being riveted together and secured to rails with bolts through rail flange make them more difficult to repair and more likely to be destroyed entirely from hard blows than the Ellis.

In order to install an Ellis post the railroad furnishes the following:

1 tie	\$0.55
1/2 yard concrete	3.00
Labor, 2 men, 1 day	5.00
	<hr/>
	\$8.55

To install a Gibraltar bumping post, the railroad company furnish the following:

29 lineal ft. 80-lb. rail, \$31.81 per ton .	\$12.32
15 lineal ft. 65-lb. scrap, \$17 per ton .	2.36
7 track ties	3.85
Labor installing, 3 men, \$1.75; 1 man, \$2.50	7.75
	<hr/>
	\$25.48

I.

PILE AND FRAME TRESTLE BRIDGES.

(No report.)

A. S. Markley.—I should like to know what stringers are being used by various roads in trestle work, giving number of strips under each rail, size of same, length of reach or span.

Of course, the weight of rolling stock decides on character of stringer used. Our present standard is four stringers, 8x16, under each rail, 15 foot reach or span, packed one inch apart, 8x8, 9-foot tie, sized to 7¾ inches, drift bolted to stringers every fourth tie, no corbel. Previous to above standard we used three ply, 7x20, 14 foot reach, four feet long, 7x10 corbel, 6x8, 9-foot tie, dapped to five inches, fitting tight over stringers. All methods have their advantages. First named or present standard: In order to line the trestle by throwing ties, it is necessary to draw out drift bolt and put in another place, on account of not missing the hole in stringer. After being lined the bridge does not get out of line sufficiently to miss the hole in the stringer. It is impossible to thoroughly inspect the two center members only on top and bottom edges. Short bearing on cap where splices are made in stringers, more particularly where cap has sap or wain, corbel would overcome this. Change of ties from 6x8 to 8x8 wherein all previous ties were 6x8 makes it somewhat expensive to repair, the rail likely to kink where only secured to stringer every fourth tie. Rails are usually tighter on bridges than anywhere else on the road, on account of their location, usually where there is a sag in the grade and where the force is concentrated.

Renewal of trestle with piles where four strips are used makes it impossible to drive two piles between them where it is desirable to do so.

The advantage of previous standard 7x20 three ply stringers, 14-foot reach, the same sized tie being used that has been heretofore used, makes repairs economical. Ties dapped tight over stringer one inch deep makes it doubly secure from expansion or springing out of rails, thereby insuring good line throughout the bridge. The use of corbels secures the very best bearing on the cap and permits lining, by sliding with a jack screw the stringers on the caps, stringers being secured to the caps in line with chuck 3x10, 12 inches long, both spiked to cap, with small chip under, at end next to the stringers to permit circulation of air between cap and chuck. Where three members are used with this depth, least deflection is secured and better inspection can be made. Under no conditions should over three members be used and preferably only two. If it should become necessary to shorten the reaches or spans to secure the desired strength in stringers, corbels should be used and every tie dapped. Covering stringers with No. 22 galvanized iron is objectionable on account of making it impossible to properly inspect the stringers.

Mr. Reid.—This is a broad question. The designing of a pile trestle bridge really is not included in the work of this association. Undoubtedly, however, on a good many roads the superintendents of bridges and buildings practically have the designing of their own trestles, and I have been thinking of that some during the past year, that it might be well to establish a standard plan of trestle. Our standard is a three-course nine by eighteen stringer for a fifteen-foot panel, using selected stringers.

Mr. Clark.—The standard pile trestle on the B. & O. road is four piles capped with a twelve by fourteen of hard pine. Our standard plan for a twelve and one-half foot span is three ply eight by sixteen chord for a fifteen or

sixteen-foot span four ply eight by sixteen. Anything over sixteen feet up to twenty feet is five ply. We use no corbels whatever. The tie is eight by eight, framed, to seven inches, using a six by eight wooden guard rail framed to five inches, and on some of the heavy curves we use an inside iron guard rail for protection of the bridges in times of derailment. I think that is all the dimensions that I remember of for our standards.

Mr. Aldrich.—On the New York, New Haven & Hartford road we have a blue print furnished by the engineering department and this blue print gives the size of stringers to be used for any opening that we may have. We use all hard pine timber for our stringers and eight by eight ties, eleven feet long, sized to seven inches, with a six by eight guard rail, and in our pile trestles we use four piles to a bent. I believe this is about all I have to say about it. I have a blue print here with me which I have had for some time and there may have been some changes, but it shows what is practically being used at the present time.

N. Y., N. H. & H. R. R.

Hard Pine Stringers Under Each Rail.

Span C. to C. Bents.	1st Class.	2d Class.	3d Class.
8 ft.-0 in.	2-7 in. × 16 in.	2-8 in. × 14 in.	2-7 in. × 14 in.
10 ft.-0 in.	2-9 in. × 16 in.	2-8 in. × 16 in.	2-7 in. × 16 in.
12 ft.-0 in.	2-12 in. × 16 in.	2-10 in. × 16 in.	2-8 in. × 16 in.
14 ft.-0 in.	3-11 in. × 16 in.	2-12 in. × 16 in.	2-10 in. × 16 in.
16 ft.-0 in.	3-11 in. × 18 in.	2-12 in. × 18 in.	2-12 in. × 16 in.

NOTE.—1st Class Includes 78 Ton Consols, 72½ Ton Mogul and 65½ Ton Passenger.

2d Class Includes 72½ Ton Consols, 64 Ton Mogul and 61 Ton Passenger.

3d Class Includes 56 Ton Mogul and 55 Ton Passenger.

Fiber Stress about 1,000 lbs. per square inch, no impact.

Mr. Canty.—I have always been under the impression that dapped ties on wooden trestles are unnecessary. The stringers as ordinarily arranged are directly under the rail,

and the tie serves only to hold the track to proper gauge and alignment. For this purpose the ties six inches deep are thick enough and anything thicker than that would apparently be wasteful. Besides, the dapping of the tie takes considerable labor. I think the cheaper way, which is fully as effective, would be to spike your ties. Spikes three eights by ten will answer. It would seem to me that if you can save one inch thickness in the tie it would be worth striving for, everything else being equal.

Mr. Penwell.—Do you mean to spike each and every tie?

Mr. Canty.—On our road we use spikes in every tie, staggered in the stringers.

Mr. A. S. Markley.—What size stringers do you use?

Mr. Canty.—For fifteen-feet spans we use two ten by sixteen stringers, hard pine under each rail.

Mr. Parker.—I have listened with considerable interest to this discussion. On my division of five hundred miles I have about forty thousand feet of wooden trestles and would like to know of the experience of some of the members with reference to using galvanized iron covering for the chords and caps. Our standard plan provides for the use of No. 26 galvanized iron covering. We use four seven by sixteen stringers in each chord for a fourteen-foot span. We do not use any corbels, and we use a six by eight tie, but do not dapp the ties. I do not like the idea of dapping the ties.

Mr. Penwell.—We are not using iron covering of any kind on our stringers, but we are using *avenarius carbolineum*, and it is proving very satisfactory with us. We have been using it two or three years. It is no protection from fire, but it preserves the timber.

Mr. W. O. Eggleston.—As it is getting late, I move that we continue this subject tomorrow morning.

President.—We are ready now to hear from the members relative to protecting the stringers by covering with galvanized iron.

Mr. W. O. Eggleston.—We cover our stringers and caps with galvanized iron.

Mr. Reid.—About eighteen years ago we covered our stringers and some of the caps on the Lake Shore road with sheet iron, using galvanized and some painted black iron. It makes a fairly good protection for the stringers against fire, as well as against rot, but the circulation of air around the stringers is not as good for drying out. On the other hand, the stringers are kept more free from water. It might be a good thing, but whether it is good enough to warrant the additional expense of maintaining it is a question.

Mr. Killam.—We have covered chords with zinc. I constructed a bridge of a two-hundred and ten foot span in eighteen hundred and sixty nine, and the chords were covered with zinc across the top of chords and clamps, which were of hackmatack and nailed with zinc nails, and it stood twenty-three years and the clamps were apparently as good as though it had been in but six months, looked perfectly good. There is no question in my mind but that covering with zinc is preferable and that it will add double the length of time to the life of the timber.

President.—In looking over the reports I have noticed that subject number seven is to cover this point, and I do not think it advisable to carry on the discussion longer on this subject, and I would like to ask the members in talking about these reports to try to confine themselves strictly to the subject in hand. The main point I think we are now interested in finding out is the size of the stringers generally used and the length of spans, the size of the tie, etc., and I would like to hear from every member on that point.

Mr. Staten.—I would like the members to say what size stringers they use and what the length of span is on the different roads all over the country.

Mr. W. O. Eggleston.—We have for the various length of trestles a standard plan, but I did not come prepared to say just what those standards are.

Mr. Large.—On the Pennsylvania Co. lines, with which I am connected, we have a regular standard for sizes of stringers, to be used according to the length of span, but we do not use anything longer than sixteen feet, for which we use three stringers, ten by eighteen, on a sixteen-foot span. Of course we have storage trestles of twenty-foot spans, but they are only used for storing. We use corbels on all trestles, and do not pretend to build trestles for main line at all without putting corbels on. We use six by eight wooden guard rails.

Mr. Perry.—On the Reading system, in relation to stringers for trestles, we calculate the strength required for length of span. The amount of timber or square inches that is required for a certain length of span must be figured upon, the same as for truss bridges. We have been using for a 12-foot span two 9x16 stringers and the strength of timber necessary to safely carry any load can be computed.

President.—Anything more on this subject? If not, we will pass it.

Mr. Sibley.—I would like to hear, Mr. President, a little further expression as to the manner of framing the ties or just placing them on the sides with dapps, as there seems to be a little difference of opinion.

Mr. W. O. Eggleston.—I might say our tie is eight by eight, nine feet long, sized to seven and one-half inches.

Mr. Clark.—The standard B. & O. tie is eight by eight, nine feet long, sized to seven inches and all ties are dapped.

Mr. Killam.—Our standard ties on the Intercolonial railway are eight by ten, hard pine, twelve and fourteen feet long, according to the bridge. The rule is that nothing less than twelve feet in length ties shall be used.

Mr. H. H. Eggleston.—Our standard tie for pile and frame trestle is seven by eight, nine feet, six inches long, sized to six inches.

Mr. Wolf.—We use fourteen by fourteen caps and eight by eighteen stringers, three stringers under each rail, and we separate them by means of a three-inch spool washer.

Our ties are eight by eight, surfaced to seven and three quarter inches, but not dapped. We do not dapp any ties or use any corbels. Our guard rails are six by eight and dapped to five inches, which serves to hold the ties in position.

II.

WATER SUPPLY.

(Standing Subject No. 2.)

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

CHICAGO, ILL., July 29, 1907.

I give you below results of several tests made on the Illinois Central which show results obtained under different conditions at several of our pumping stations. I also give you results of a test made under working conditions on an 8" pipe line 17,000' long, located at what is known as "Big Muddy Pumping Station" and at which time we were pumping 750 gallons per minute through the main and were maintaining a pressure of 125 pounds at the pump house.

You will note that these tests were taken at a distance of about 1700' and shows about an equal resistance between each test. Taking into consideration the number of elbows in the line, this is somewhat lower than we would calculate theoretically, and for this reason the results are given on attached sheet.

C. E. THOMAS,
Chairman.

RECORD OBTAINED ON 8 INCH PIPE LINE, BIG MUDDY
PUMPING STATION.

Test No.	Location.	Pressure.	Difference.	No. Ell.
1	Under tank (60 feet head)	89	18	2-90°
2	3,400	60	21	2-90°
3	5,100	65	5	0
4	6,800	84	19	2-90°
5	8,500	90	6	0
6	10,200	105	15	4-45°
7	11,900	115	10	2-45°
8	14,600	123	8	0
9	16,300	125	3	0
	(690 feet So. Pump-house)		100	9

Big Muddy to R. H. Tank 16,990 feet 8 inch C. I. Pipe.

DISCUSSION.

Mr. Thomas.—Your water committee has not prepared a very elaborate report, but we have a statement of some tests which were made under working conditions, showing the different types of pumps used on the Illinois Central and the difference in lift, difference in hours pumped and length of the discharge is given; also the amount of fuel consumed. It is possible some one might wish to ask questions in regard to these tests, and if so, we will be pleased to answer them.

Mr. A. S. Markley.—I would like to ask in their investigations if they encountered any one who turned the exhaust into the suction pipe, thereby heating the water for the purpose of saving fuel in the winter and preventing freezing.

Mr. Thomas.—We did not investigate that matter, but still it is practised on some of the roads, and so far as my experience goes, there is nothing objectionable in turning the exhaust into the suction line.

Mr. A. S. Markley.—In conversation with one of the members I have learned something of which I never heard before and that is concerning the use of coal oil in connection with gasoline engines; that is, pumping for about twenty

minutes with gasoline and then turning off the gasoline and using coal oil or kerosene. I certainly intend to try that in the future.

Mr. Swenson.—We are experimenting with kerosene in place of gasoline. I use one tank of kerosene and one tank of gasoline, and start the gasoline engine with gasoline and run it for twenty minutes, until the cylinder becomes hot, then, I turn the gasoline off and start it with kerosene and have the gasoline engine run all day on kerosene. I have done this on one coaling station for four months, and I think it will be a great saving to the company if we can be sure it will run satisfactorily, as we pay only seven cents per gallon for kerosene and eleven cents per gallon for gasoline.

Mr. A. S. Markley.—Did you make any change in the engine?

Mr. Swenson.—No, sir, we have not made any change in the engine. We just have two tanks, one for gasoline and one for kerosene, and all we do is to turn the gasoline off and put on the kerosene.

Mr. Montzheimer.—The manufacturers of gasoline engines are prepared to modify them so that kerosene oil can be used wherever desired. I understand a ten or twelve horse power gasoline engine can be fitted up for using kerosene for about \$50, so it makes an efficient engine and very nearly of the same horse power as the one designed for gasoline exclusively. Of course it makes a large saving in cost of fuel.

Mr. Joslin.—I have had some experience in using kerosene on a gasoline engine, but I never had any satisfactory results, and I have mixed gasoline and kerosene together and done a certain amount of work with it, but could not get a perfect combustion, and it was not entirely satisfactory, and I do not believe it is of much value to use the kerosene except as a lubricant.

Mr. Clark.—I would like to ask Mr. Montzheimer if they change these engines to use kerosene entirely or whether

they are fixed to start with gasoline and then turn on the kerosene, that is, in regard to changing the engines so as to use kerosene, as he spoke of.

Mr. Montzheimer.—We have not had any of our engines changed. All of our engines are made for gasoline exclusively, but Mr. Fred Von Schlegell, who is mechanical engineer for Fairbanks, Morse & Co., told me that he could put this attachment on our engines, so that kerosene could be used exclusively and no gasoline would be required.

Mr. Powers.—I would state in addition to the remarks of Mr. Montzheimer, that during the conversation I had with the Fairbanks, Morse & Company's man, he recommended that we have a gasoline tank as well as kerosene, and to use the gasoline for starting, and after started then apply the kerosene, otherwise they would have to devise a special torch for exciting a gas from the kerosene, in order to start up, and that would make an additional expenditure. He thought any contrivance for generating gas from kerosene would answer the purpose.

Mr. Clark.—I would like to inquire of Mr. Powers if it is not a fact that when the engine is shut down and when started up again, would not kerosene be a detriment to the gasoline?

Mr. Powers.—The way it has been explained to me, I believe not, and that there would not be an influx of kerosene. It would take a greater degree of heat to generate gas from kerosene than from gasoline, but I understand it would all generate so that there would not be any oversupply at time of shutting off the power.

President.—If nothing more on this subject, we will proceed to the next one. This discussion has been a very interesting one.

III.

FIRE PROTECTION.

Standing Subject Number Three.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Our Fire Protection on the Oklahoma Division of the C., R. I. & P. Ry., is composed of water barrels placed at all the trestle bridges, one at each end of the trestle and one barrel every fifth or sixth bent. These barrels are filled with water and it is the duty of the section foremen to see they are kept filled. In addition to this the section foremen are required to keep vegetation and rubbish of all kind cleared away from wooden structures and buildings on their respective sections.

This last May our people adopted a fire proofing covering for pile and timber trestles, which I consider an excellent thing. (See blue print attached.)

For our station buildings, if at towns where there are city water works, we instal fire hose. At the smaller stations where city pressure can not be had, we go back to the water barrel system, placing one barrel at each end of the station building. Also at stations where water tanks are located we have hydrant and hose connection and use tank pressure in case of fire.

This is practically the method of fire protection used by the majority of the roads west of the Missouri river.

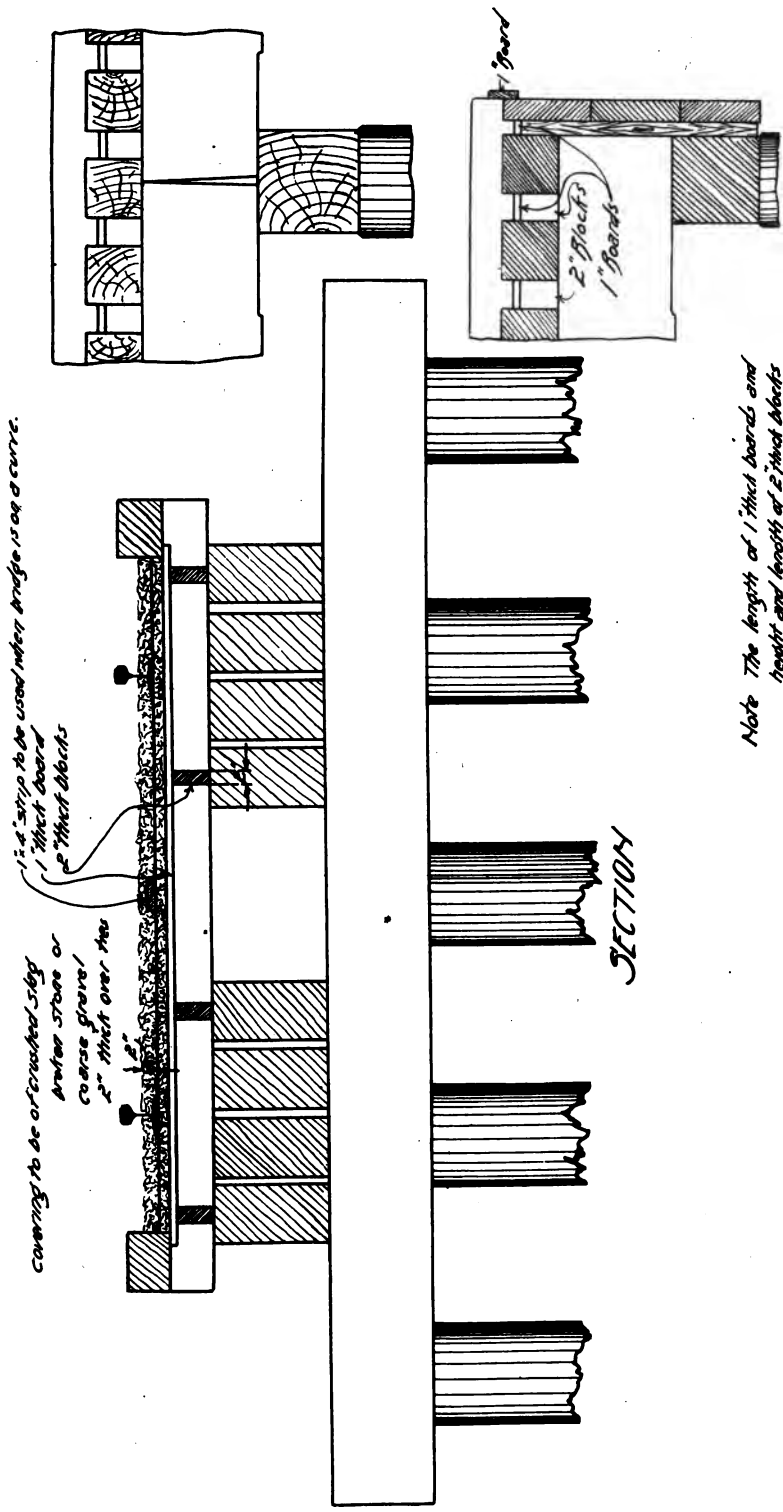
WM. CARMICHAEL.

FRESNO, CAL., September 21, 1907.

Our protection is practically the same all over the Santa Fé, especially so on the Coast Lines. In small towns where we do not have city protection we use switch engine with small duplex pump with hose attached and in small stations where switch engine is not available we use the standard underwriter fire extinguishers which we find are very effective in putting out small fires, but are of no use when fire gets any headway. I find that our switch engines are very effective in putting out small fires around station and throughout the yard. I cannot state positively in regard to other roads, but what I have noticed I find they use the switch engine and pump where available and the fire extinguishers in small places.

D. A. SHOPE.

WM. CARMICHAEL,
D. A. SHOPE,
A. SHANE,
S. F. CLAPP,
Committee.



Note The length of 1" thick boards and height and length of 2" thick blocks are governed by conditions existing at each bridge

FIG. 1.—Fire Proofing for Trestles. C. R. I. & P. Ry.

DISCUSSION.

President.—Those who wish for information in regard to covering stringers and caps will be right in line at this time and can obtain that information now.

President.—In talking with a member this morning, he told me that caps which had been in use for twenty years were just as good when the bridge was taken down as when they were put on, and I would like to have him make it known in the convention.

Mr. Swenson.—We have used galvanized iron on top of our caps, covering the whole length, and I also put galvanized iron on top of the stringers over the caps, using No. 28 galvanized iron, 30 inches wide by 72 inches long, two pieces. This helps to protect the stringers from getting rotten; also helps for fire protection. I have taken the timber out of some of the bridges that we filled and found the caps to be very good, and one bridge I filled, in which the caps had been in use for seventeen years. This goes to show that the galvanized iron is doing some good.

Mr. Staten.—May I ask the location of this bridge?

Mr. Swenson.—This bridge is located on the Soo line, Missouri River division, North Dakota; number of bridge, X-303-A.

Mr. Clark.—In regard to the matter of fire protection on our trestles, my experience has been with caps on trestles, as referred to by the gentleman on my right, is that nine times out of ten I have always found the cap to give out on the underside, on the heads of the posts. The posts commence to shove up through the cap and that being the case, I do not think the covering would make much difference.

Mr. A. S. Markley.—Mr. Clark's experience is quite different from any that I have had. The decay of the caps has always commenced on the top and the stringers invariably start rotting from the end and top. Mr. Swenson's idea is feasible in regard to the protection of the stringers where they first give out, at the end. On one part of our

road, near our terminal at Chicago, we had a good many fires on the trestles, on account of the engines being fired up with wood, when just starting out, and they would set fire to these bridges three or four times a year, and in that particular case we keep these bridge stringers covered with galvanized iron, and it has reduced the number of fires, in fact we have had no fires since we have done this. As to the cost, if I remember correctly, it is about 30 cents per lineal foot for the labor and material, No. 22 galvanized iron.

President.—Has any other member anything to say on this subject? This is a very important subject, indeed, because of the question of the high-priced timber, and it is worth the while to protect it. We have protected our stringers and decks for the last fifteen years and for your information would state that we have a deck on one bridge that has been on fifteen years and the stringers are just as good as the day they were put on. But of course a better class of timber was used than we get now. I never cover the stringers when I build the bridge new, but leave it open for a year until the sap gets out and to permit the timber being properly seasoned. Then we put on the galvanized iron. We use twenty-eight inch galvanized iron for the covering, No. 22. It costs us 25 cents per lineal foot put on the bridge, and that is a very small expense.

Mr. Reed.—As I understand it, you put on the stringers and then let them season for a year before you put the covering on. I would also like to inquire if you put it on the entire stringer.

President.—Your understanding is correct and we put it over the entire stringer from one end to the other.

Mr. Wolf.—I would like to inquire of the president if he uses line spikes.

President.—No, sir, I do not use any line spikes and I do not like them.

Mr. Parker.—We do not use any line spikes, but I have

noticed that where the ties give out first is under the rail where the track spikes are driven in, and sometimes it is necessary to pull a spike and respike it, and it leaves a hole if not plugged up.

Mr. Canty.—No doubt the line spike affects the length of life of the tie somewhat, but if you do not use them, it is necessary to dapp the tie. I think, considering everything, a line spike is more economical.

Mr. Aldrich.—In relation to dapping the tie, I would state that in our part of the country we use hard pine and it is difficult to get timber without sap, and in nine cases out of ten, the dapp is in the sap. We put the sap side down, and as I said before, generally we get rid of the sap.

Mr. Penwell.—About the protection from fire and weather, we have never used any iron covering, but have always thought it might be a good thing, excepting that it prohibits the proper inspection of the bridge when the stringers begin to decay. Another protection that has been offered by a number of the roofing companies is an asbestos covering which they recommend for use over the stringers, but I have always been under the impression that it would wear through in a year's time and have not considered it. I had in mind that nothing less than No. 24 galvanized iron would answer the purpose. We are using avenarius carbolineum, and it is very satisfactory with us so far; but that does not protect from fire. One of their representatives stated that it would be a certain protection, but I do not agree with him. It is very inflammable, and while it does not protect us from fire, I am satisfied it is very good protection from the weather. We have to protect our bridges in some way and I wish to know whether it is practicable to go on and use carbolineum. Assuming that it is of value, then arises the questions of how to protect against fire. For myself, I like the way the discussion points in regard to the iron protection.

Mr. Killam.—I think the zinc, if properly put on with copper nails, affords splendid protection and will add very

much to the life of the cap or stringer, but I consider it useless to put on this material with any other than copper nails, for the reason that if you do they will rust out too soon.

Mr. Sibley.—In regard to this matter of fire protection for bridges and trestles, I am here for information and I should like to know the best method of protecting them against fire, and whether water barrels are effective or not.

Mr. Perry.—In reference to using galvanized iron as protection from fire, would say we have some trestles covered with iron, more for protection against fire than decay. I will admit that I have noticed a great many trestles protected in this way, where the timber is better than where it was not so covered, but there is not as good a chance to examine the timber when it is protected in this way. But for fire protection, a covering of galvanized iron is effective.

Mr. Staten.—Our greatest trouble in regard to trestles being burned is on account of the firemen shaking the grate bars while passing over the trestle. We are always admonishing the master mechanic and the engineers to stop it, but we do not accomplish it. They seem to know just where the trestles are and they dump the grate bars at those places and set the trestles on fire, and we only use the water barrel and a tin bucket or an old powder keg sunk in the barrel for protection against fire.

Mr. Sibley.—I should like to inquire whether or not the water barrels on each end or in the center are effective as compared with the cost of maintaining and keeping them there. I should say it is more or less expensive to maintain water barrels and the question in my mind is whether or not there is sufficient good attached to warrant the maintaining of the water barrels.

Mr. Staten.—I have known of two or three bridges which have been saved by having water barrels on them, and in that case it certainly paid to maintain them.

Mr. Killam.—On our bridges for fire protection we use water casks with a tin or galvanized iron bucket put in the

bottom, and I have known of two or three cases where bridges have caught fire and where the fire was extinguished by the use of these water casks. The trackmen are required to keep them filled with water, and there is hardly any bridge but that has water underneath. If, upon inspection, those barrels should be found nearly empty, the track foreman would be questioned as to the neglect and report to the engineer of maintenance.

Mr. Canty.—My opinion is that a water barrel on a bridge is a useless and expensive arrangement for preventing fire. Experience has taught me that water barrels require renewing about once a year. To be of any use in case of fire, pails should also be provided. Pails are continually being stolen, carried away or thrown away, so that this scheme results in considerable trouble to maintenance of way employees. It is my opinion that the energy used by the railroad forces in taking care of those water barrels and the money involved in supplying them could better be spent in keeping the structure free from decayed sap or painting the deck of the bridge. The water barrel does not protect bridges as it should, because it is often empty. If the barrel is buried in the ground it will rot quickly, and if it is on top of the bridge it falls to pieces through the effects of the weather.

Mr. Parker.—On our principal bridges we use water barrels and each barrel has a burlap sack attached that can be used in case of a fire near by, by being thrown on the fire, and at each end of the bridge we have a barrel provided with a hinge cover, with a hasp and lock, using a switch lock, in which barrel we store water buckets, so that any railroad person coming along who should discover a fire can easily obtain these buckets. We could not maintain buckets at the barrels, because the tourists are quite numerous, traveling from the East to California, and they would use them for washing purposes or carry them away.

We have prevented quite a number of what would have been very expensive fires on bridges by having these water

barrels and we do not have any trouble on account of the water freezing in our part of the country.

A. S. Markley.—In addition to providing our bridges with water barrels filled with water, we endeavor to keep all rubbish and grass cleaned away from around them to prevent them from taking fire. A vigorous campaign is made against poor ash pans, and whenever a bridge is set on fire, we trace it up very carefully, through the master mechanic, to have a remedy applied to prevent the fire from getting out of the fire box, locating the engine that did the damage. The water barrels are all right, but if there is nobody handy to put the fire out, what good is the barrel and bucket? A good covering over stringers that cost 30 cents per lineal foot of bridge, No. 22 galvanized iron, 36 inches wide in place, in my opinion, barring the expense, is about the safest solution to prevent the trestle from taking fire.

Mr. Clark.—In answer to the question as to whether it pays to maintain water barrels on bridges, I know of two or three cases where we would have lost the bridge, had it not been for the water barrels. Several times our bridges have been saved by having these barrels, and as to the expense, our storage department charges \$1.50 per barrel, fitted up with a cover and everything ready for use. These are then sent out to the section men, who put them on the bridge, and I think that they do not have to be renewed oftener than once in three or four years, and when they do dry up and fall to pieces, we send out another barrel; and I think it is good policy and economical for water barrels to be kept on the bridges for fire protection.

Mr. Hubbard.—In regard to water barrels, I will state that I have a regular man that looks after water barrels and pails all the time, and I know they are a good thing. I have one very large wharf of several acres and on that wharf I keep several barrels filled with salt water. This salt water or brine is boiled down just as strong as possible and it never freezes in the winter. On this trestle work

some time ago I noticed a blaze start from the ties. I went as fast as I could to that point, and close by I had a barrel of water, but before I could get there the blaze shot up almost ten feet high and if I had not had a barrel there with pails to put the water on with, no doubt the bridge would have been burned a good deal. I put water on it and two pails extinguished the fire. We have no trouble in keeping the water from freezing, and I have a large number of water pails and barrels that one man looks after, and the expense is very slight.

President.—As it is now dinner time we will have to close this discussion.

FENCES, ROAD CROSSINGS AND CATTLE GUARDS.

(Standing Subject No. 4.)

REPORT OF COMMITTEE.

To the President and Members of the Association of Railway Superintendents of Bridges and Buildings:

Your committee appointed on subject number four present the following report:

Early in the year a circular was sent to members of the Association asking for views on these subjects. A number of replies were received, some of which explained the views of the writers so explicitly that we have concluded to give them in full as written. It appears that in many cases these subjects are under the authority of the operating department, as in my case, and the road master has charge of all this work. On the line of the Duluth, South Shore & Atlantic Railway, the standard cattle guard is a surface one, made by the Sheffield Car Co., called the Saw Tooth Steel Cattle Guard. Our fences are made of five wires set on cedar posts, sixteen feet apart. Our principal crossings are made of old scrap rail, laid down flat with the ball under the ball of the track rail, for the inside and filled in between the two rails with crushed rock or gravel, and on the outside a 4-inch by 10-inch plank close to the rail.

EXTRACTS FROM LETTERS RECEIVED IN ANSWER TO CIRCULAR OF INQUIRY.

A. McNabb, Pere Marquette Railroad:

These subjects all come directly within the province of the road master, the same as on the D. S. S. & A. Ry. They have no fence standard that I know of. A number of years ago they used nothing but a barbed wire fence. The posts were set eight feet apart and five wires and a cap were used, with a board under the cap, but of late they are using chiefly woven wire and several different styles of it. We have used nothing for the last four or five years but wooden surface cattle guards. They are made at the shops and shipped as they are needed. For road crossings in cities or highways that are travelled much a rail laid flatways is used and the ball is allowed to come under the ball of the track rail and is then filled in between with 4-inch by 10-inch plank, furrowed up level with the top of rail, but on ordinary highway crossings they use nothing but plank between rails, also outside as far as end of ties. For farm crossings they just use one plank inside and one outside, and fill in between with gravel.

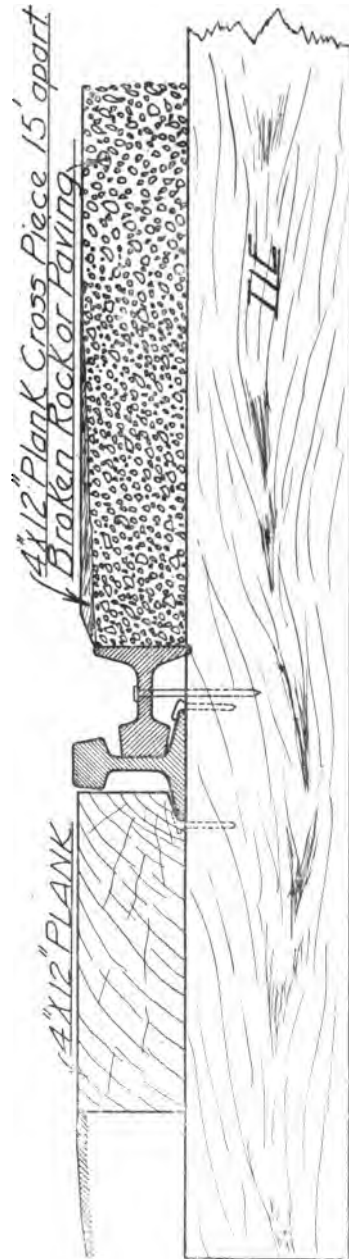


FIG. 2—D., S. S. & A. R'y. Lt'd, Highway Crossing.

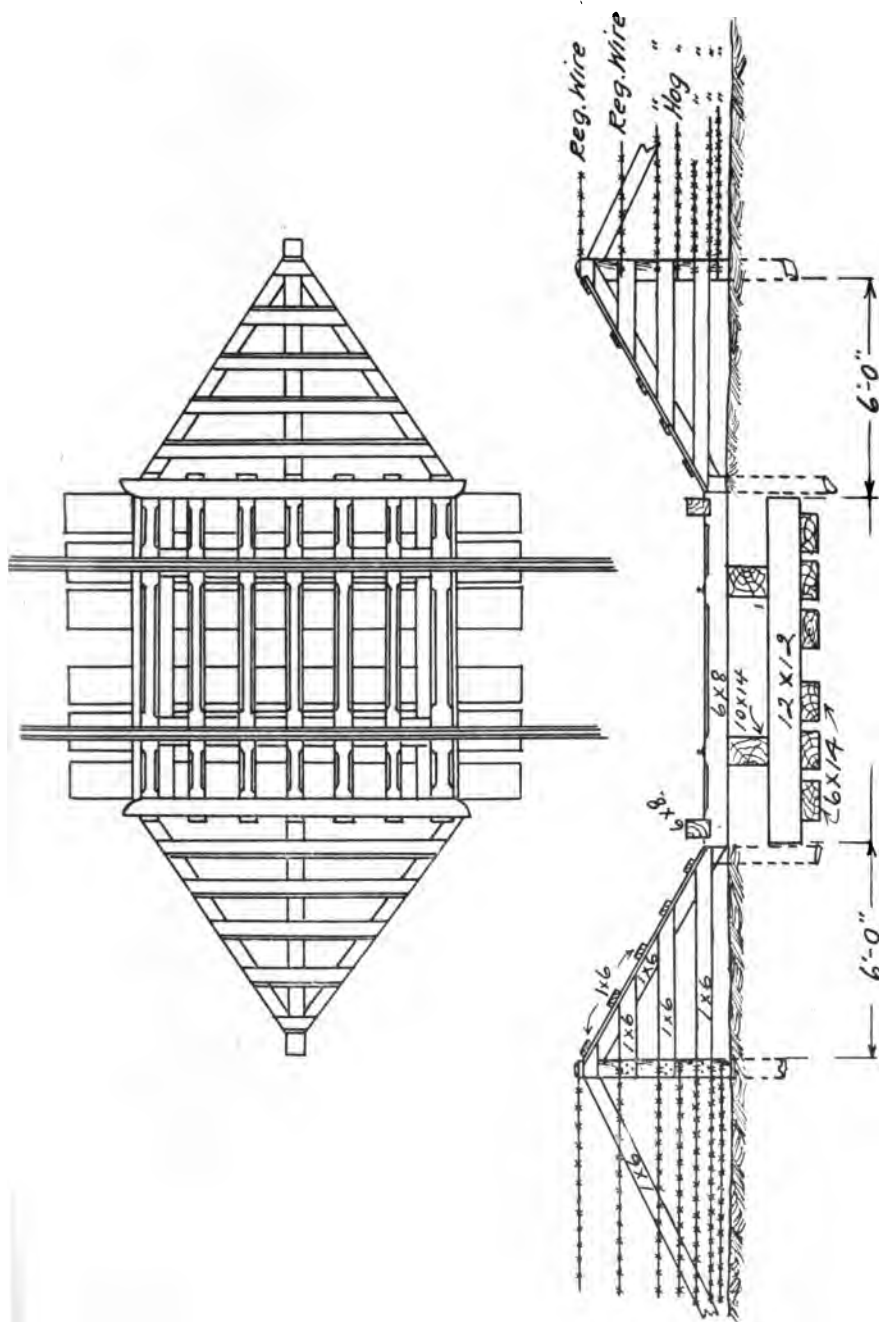


FIG. 3.—St. L. S. W. Ry. Lt'd. Pit Cattle Guard.

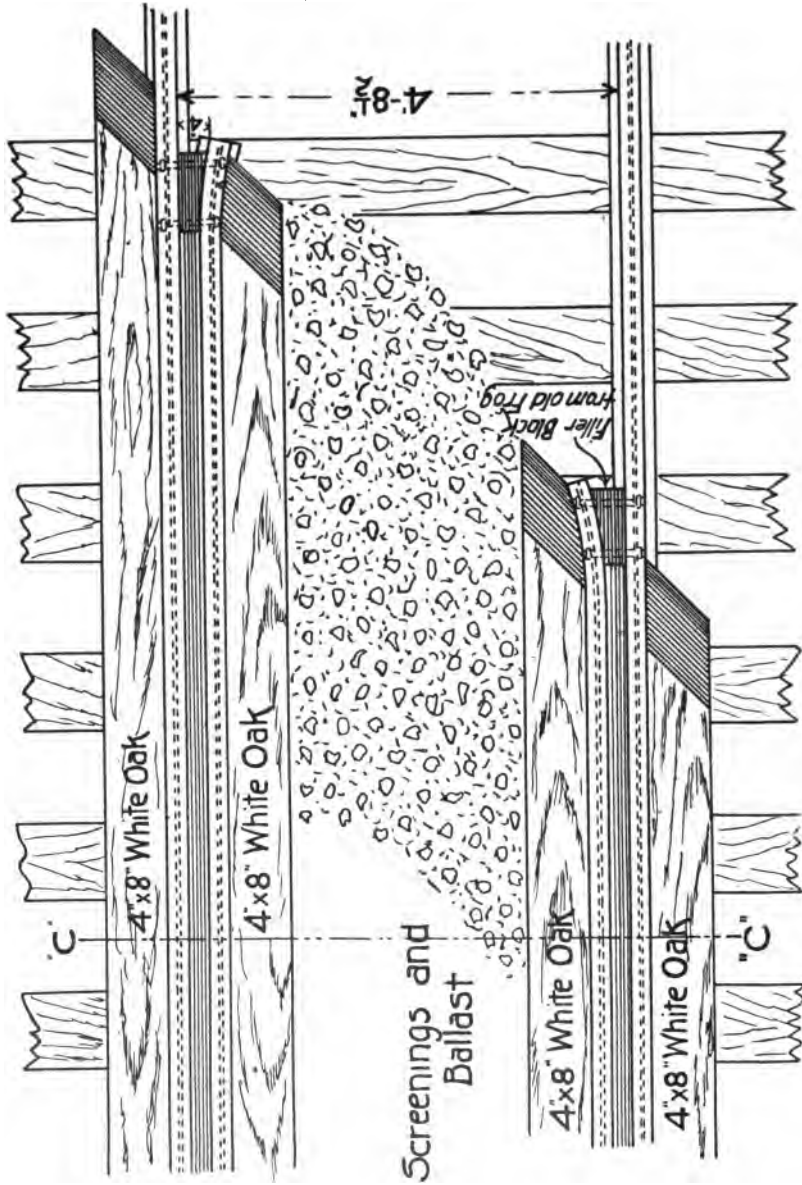


FIG. 4.—C. R. R. of N. J. Ltd. Skewed Road Crossing.

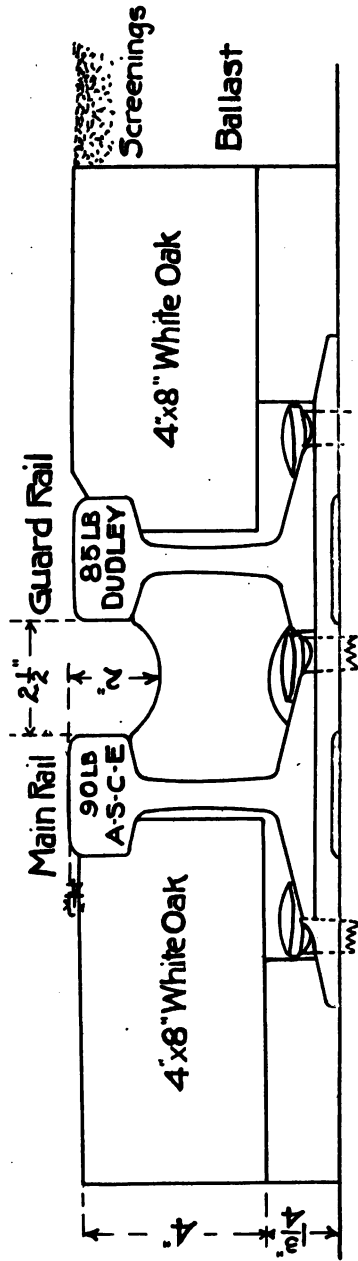


FIG. 5.—C. R. R. of N. J. Lt'd. Skew Road Crossing to Face Skew Plan.

M. Bishop, General Foreman Bridges and Buildings, San Antonio & Arkansas Pass Railway:

Style of fence used on the S. A. & A. P. is five wires with posts set $16\frac{1}{2}$ feet centers. Style of road crossing is simply four planks laid each side of rail. Style of cattle guard is wooden frame pit guard with mud sills, $12" \times 12"$ —10 ft. caps, $12" \times 12" \times 8$ ft. stringers, $6" \times 8" \times 9$ ft. ties chamfered and placed on edge. Some surface guards are used that are manufactured by the Columbia Mail Crane Co.

F. E. Schall, Bridge Engineer, Lehigh Valley Railroad Co.:

We have no standard plan for fences along the right of way lines; the Lehigh Valley R. R. Co. at present uses the American Field Fence, No. 1052, manufactured by the American Steel & Wire Company, for property fences, where the railroad company maintains them.

In many cases in the states of Pennsylvania and New Jersey the farmers along the railroad are, under the provisions of the deeds, maintaining the fences.

T. C. Burpee, Intercolonial Railroad of Canada:

The Intercolonial Railway uses almost all the different styles of woven wire fence of a height and mesh as required by law, and fully described in the attached specifications. I also attach a plan of a farm crossing gate, which is very serviceable and economical.

For public and farm crossings the attached plan shows our standard more clearly than it can be described.

The attached print of cattle guards is one which is cheap and adapted to sparsely settled districts. Where the country is settled more thickly iron surface guards are used; in fact we have tried nearly all kinds, but have yet to find one that is satisfactory.

A. L. Bowman, Bridge Engineer, Central Railroad of New Jersey:

I enclose prints of the Central Railroad of New Jersey's drawings No. 5072, standard road crossings; No. 5076, standard inter-track fence; No. 5155, standard snow fence.

The Central Railroad is now and has been for some time working up a set of standards. So far no standard cattle guard or standard right of way fence has been adopted. Frequently the snow fence is used as a right of way fence. There is also a large amount of ordinary wire fence used for right of way fence.

I. F. White, Division Engineer, Chicago, Hamilton and Dayton Railway:

We use a woven wire fence with nine strands, posts set 20 feet apart. For highway crossings, one plank each side of rail; for street crossings, plank in solid; for cattle guards we use surface guards made of wooden strips.

P. Swenson, Superintendent Bridges and Buildings, Minneapolis, St. Paul & Sault Ste. Marie Railway:

We use crossing gates in large towns, and for highways we

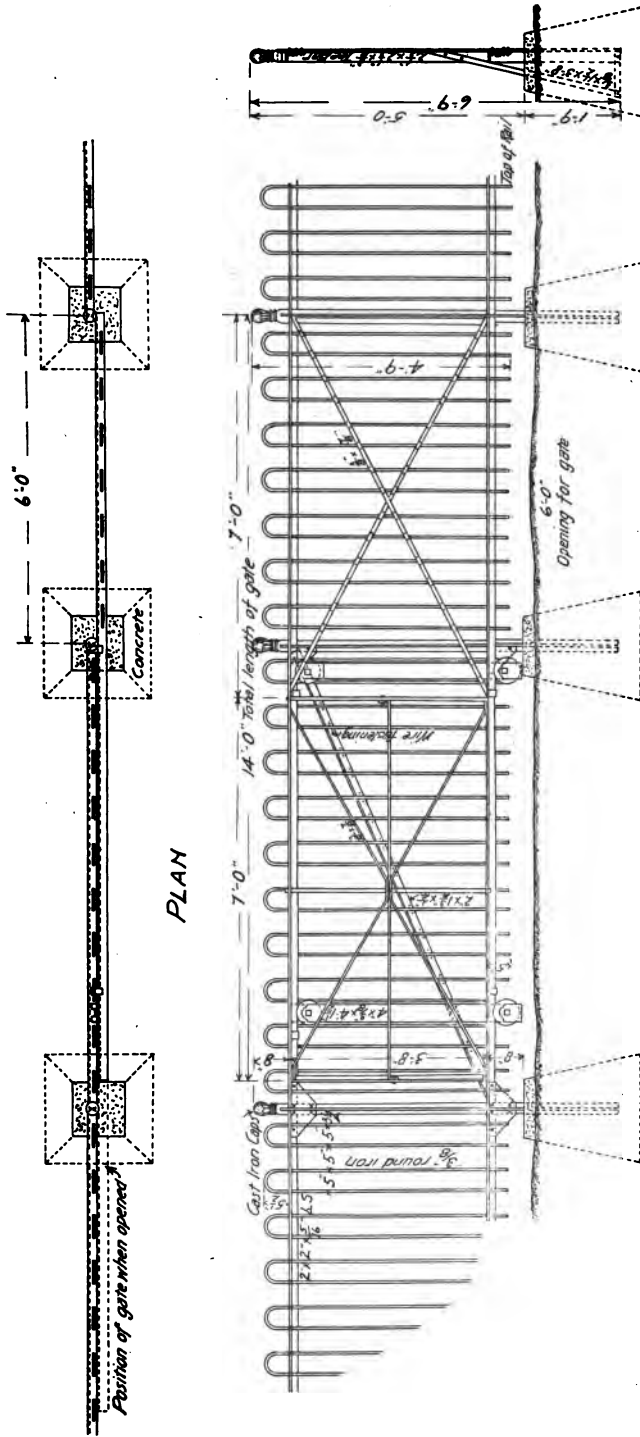


FIG. 6.—C. R. R. of N. J. L'd Inter Track Fence.

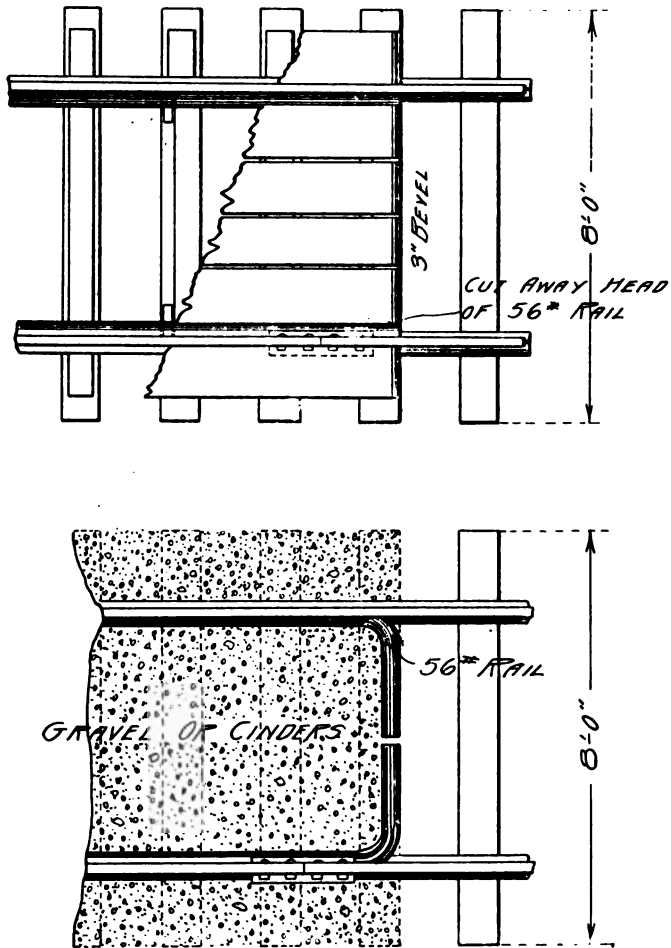
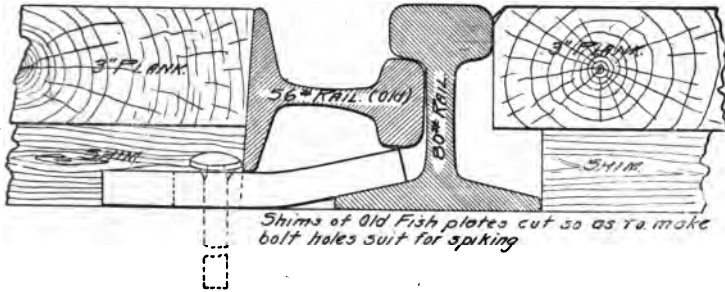
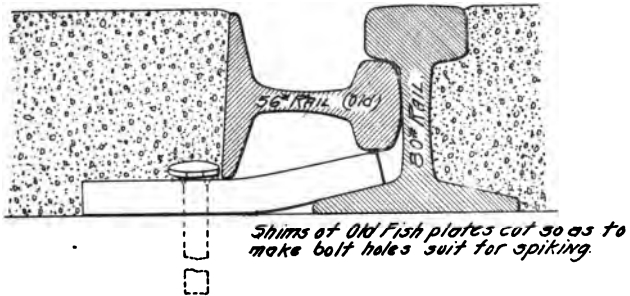


FIG. 7.—C. P. R. Highway Crossings.



PLANK CROSSING.



GRAVEL OR CINDER CROSSING.

FIG. 8.—C. P. R. Highway Crossings.

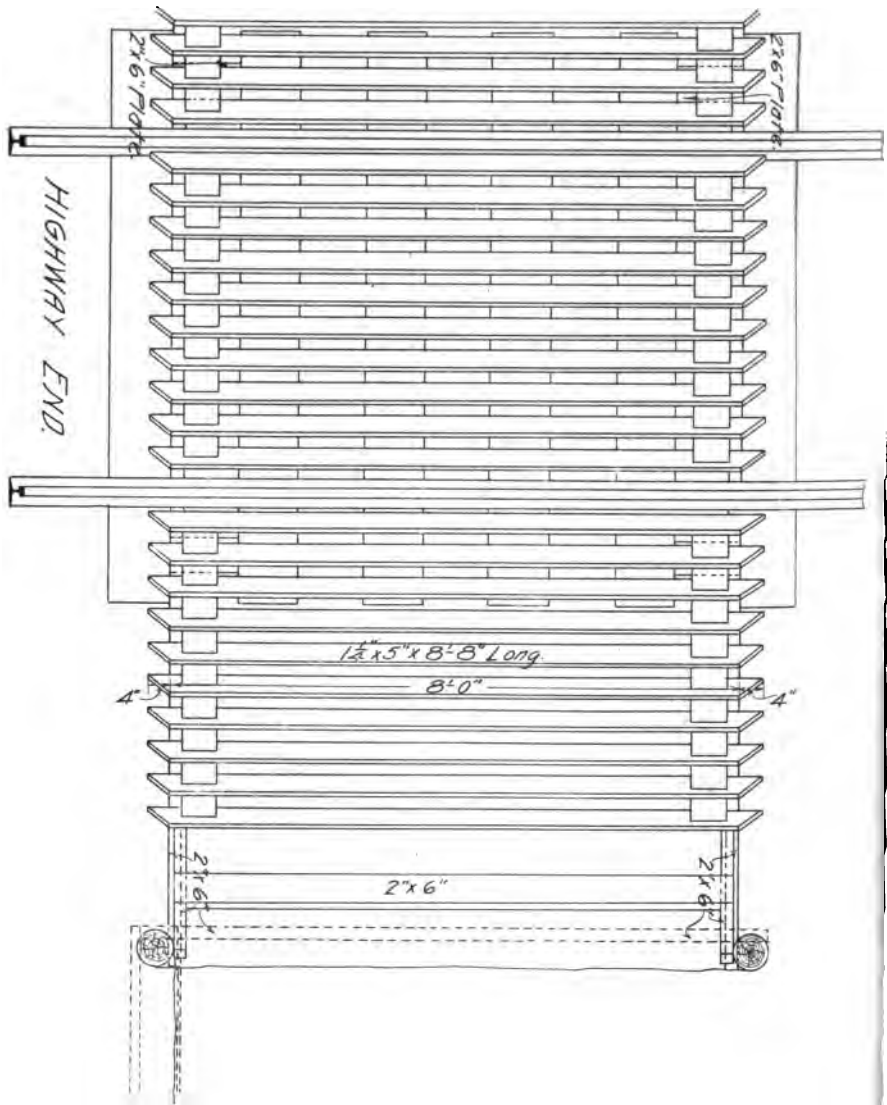


FIG. 9.—C. P. R. Lt'd. No. 3. Cattle Guard.

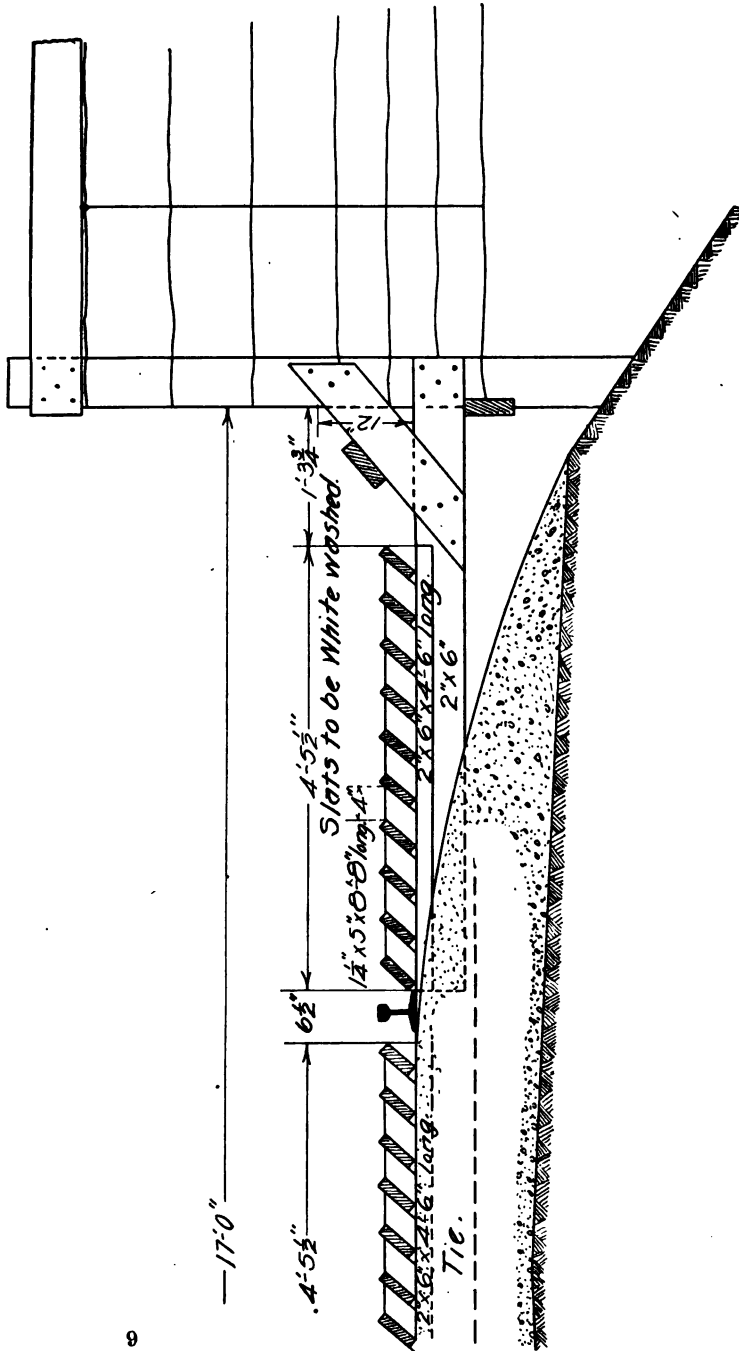


FIG. 10.—C. P. R. Lt'd. No. 3. Cattle Guard.

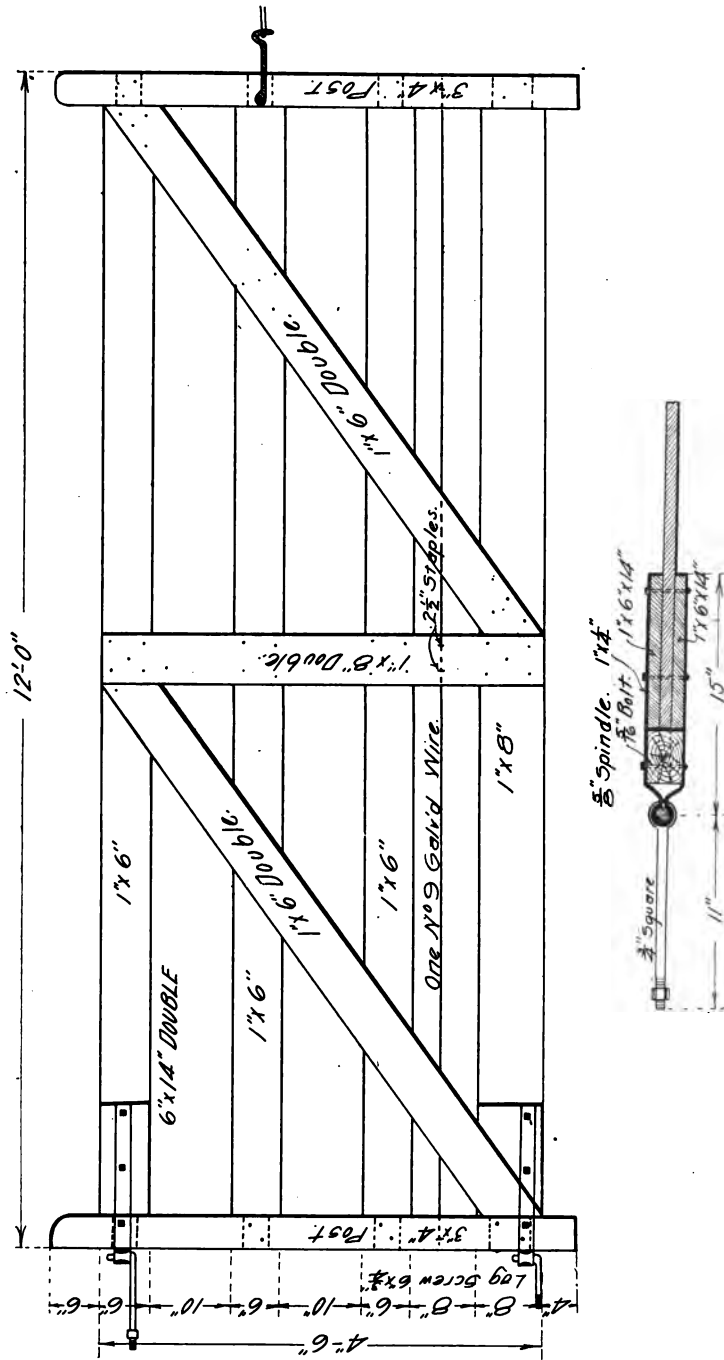


FIG. 11.—I. C. R. Farm Crossing Gate.

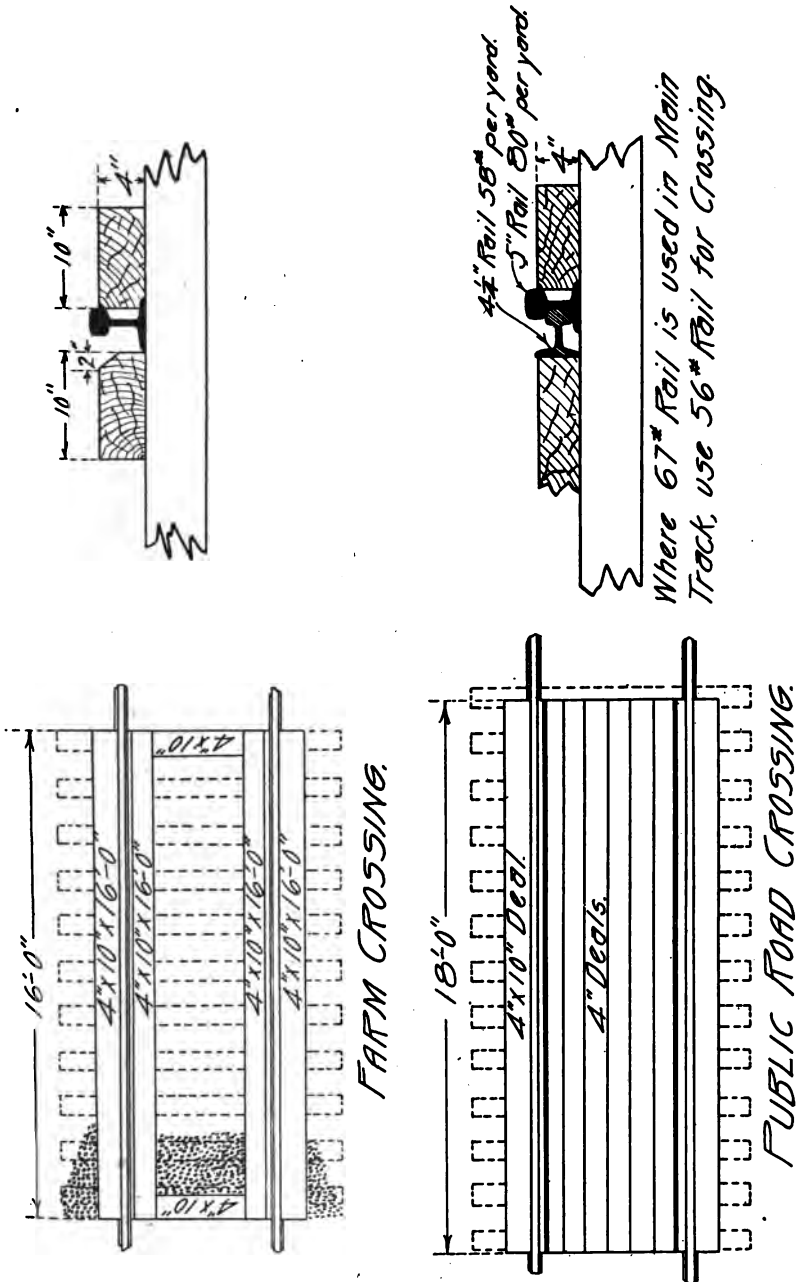


FIG. 12.—I. C. R. Crossings. (See letter, etc.)

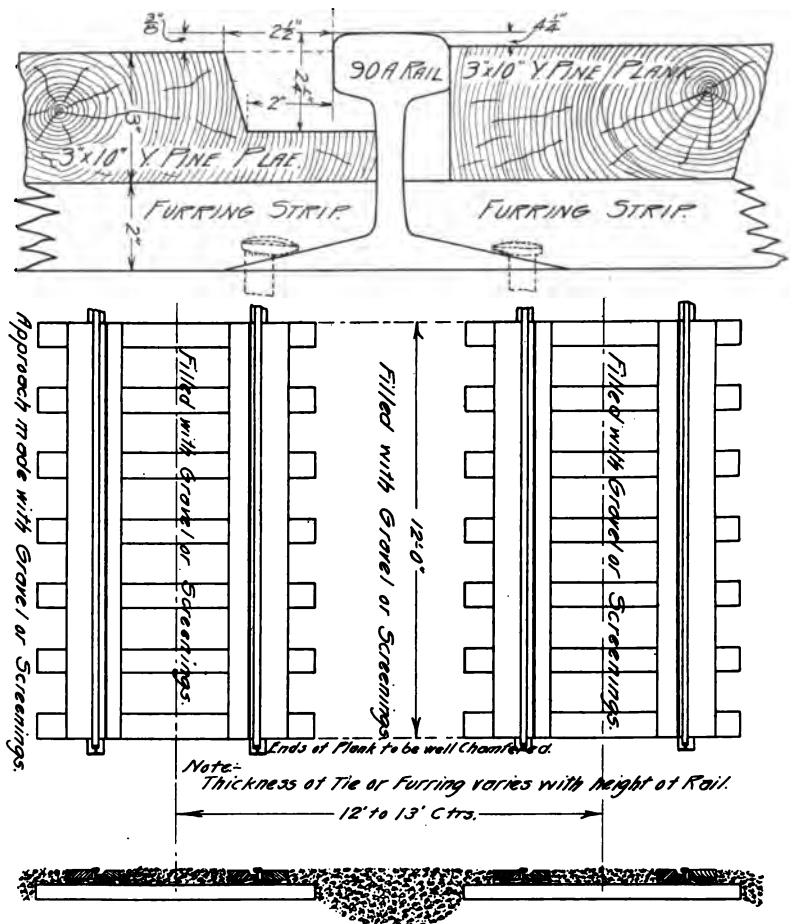
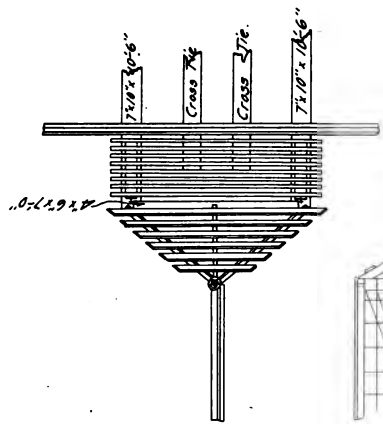


FIG. 13.—L. V. R. R. Lt'd. Private Crossing.



All wood work to be white washed.

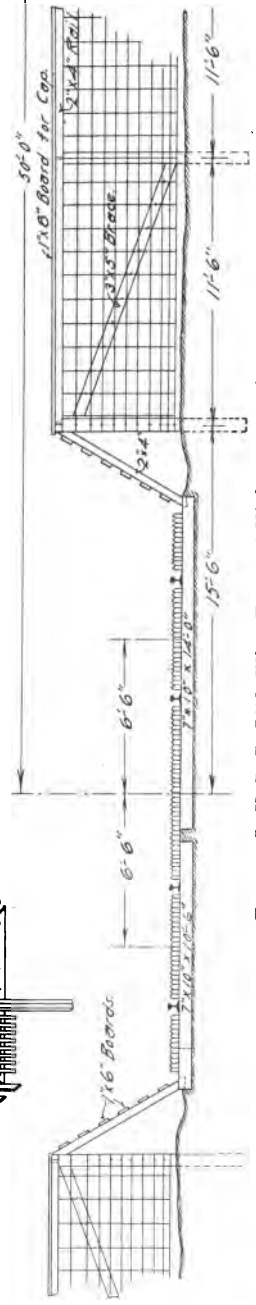


FIG. 14.—L. V. R. R. Lt'd. Wing Fence at Highway Crossings.

FENCE —
FOR USE AT STATIONS.

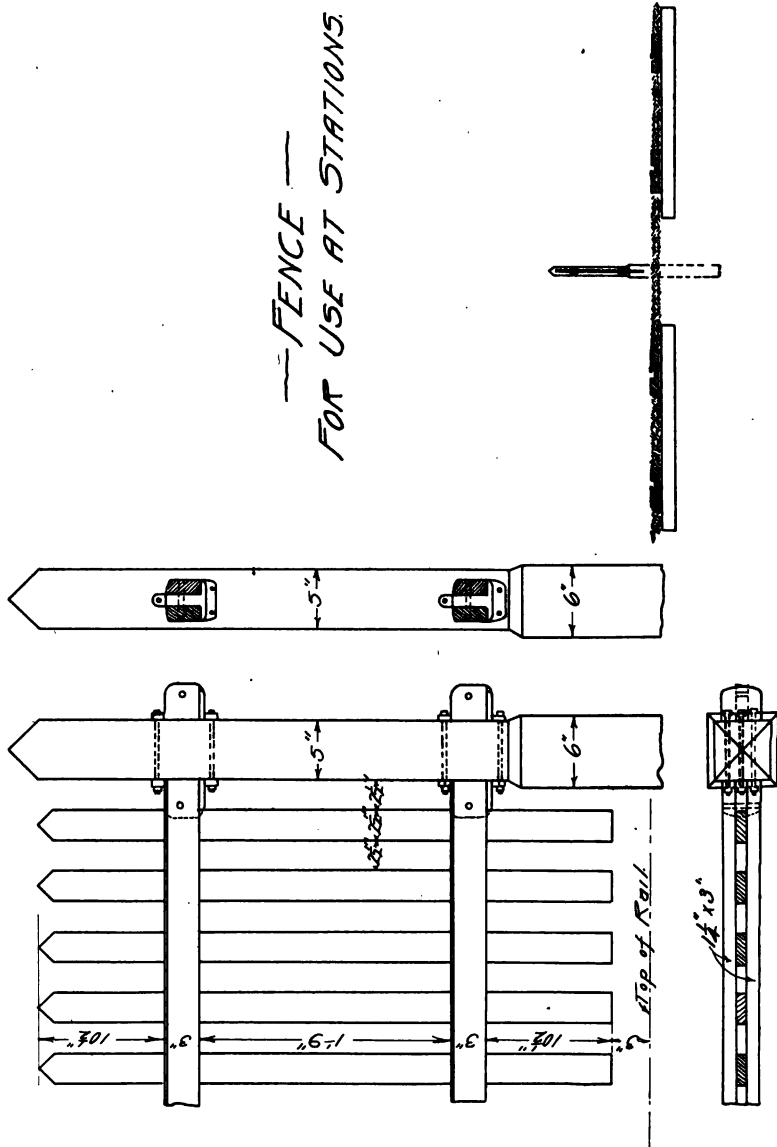


FIG. 15.—L. V. R. R. Fence at Stations.

use crossing signs. For cattle guards we use surface cattle guards, doing away with all pits. For right of way fences, we put up fences for cattle only, except in few instances, where we cross a man's farm who has hogs and sheep, and in cases of that kind we fix the fence so the hogs and sheep will not get through.

George F. Powers, Elgin, Joliet & Eastern Railway:

At present the fences, cattle guards and crossings come under the supervision of the road department, but I have heretofore had considerable to do with it. We have no standard fence plans. Fencing on the E. J. & E. is principally against cattle, but in some instances, when right of way was secured, there is call for hog-tight fences. In all cases we use 8 feet cedar posts and barbed wire. For cattle, posts are set 16 feet apart, from 3 feet to 3 feet six inches in the ground, wires are spaced beginning at ground line about 8-inch, 10-inch, 12-inch and 14-inch centers; for hogs three extra wires are put on, one below first wire for cattle fence and two in between the next two strands, making it from ground line 4-inch, 4-inch, 5-inch, 5-inch, 6-inch, 6-inch, 14-inch, 14-inch centers. This is about the practice. I attach prints of cattle guards and crossings.

I enclose blue prints from the C. R. R. of New Jersey for fences, crossings and cattle guards; from the C. P. R., the St. Louis Southern Ry. the Boston & Maine Ry., Lehigh Valley Ry., Elgin, Joliet Eastern Ry., C. & N. W. Ry., Intercolonial Ry., Pere Marquette R. R. and D. S. S. & A. Ry.

W. M. NOON.
A. McNABB,
F. W. TANNER.
Committee.

SPECIFICATIONS FOR FENCING INTERCOLONIAL RAILWAY.

Fence to be Strathy, Page, Ideal or other fencing of nine horizontal wires. The railway department will furnish to the contractor, distribute from moving cars, alongside of the railway tracks round cedar in nine feet lengths for posts, sills and braces.

The contractor shall provide wire fencing, staples, spikes, and any other materials required and all the labor required.

The..... fencing shall be made with nine horizontal wires all of number nine gauge with upright wires of number eleven gauge placed not more than inches apart, forming a web of not less than inches in diameter.

The contractor shall clear the ground of all wood, bushes, etc., for a width of nine feet on the inner side of the railway boundary line, and place the fence on the boundary line. In places where the fence is built on sills the outer end of the sills shall be placed on the boundary line. The old fencing must be removed from the site of the fence, and placed in snug piles inside of the new fence, or otherwise disposed as directed in this specification. The wood, bushes, etc., and any refuse material, bark and chips, formerly on the ground or made during the building of the fence, must be piled in convenient places as directed by the inspector, so that at a convenient time they may be burned by the railway employees, and no rubbish of any kind is to be left strewn about the ground.

Along parts of the line where the present fence consists of barbed wires, the contractor shall carefully remove these barbed wires, reel them upon substantial reels, each strand upon a separate reel which he shall provide for the purpose and hand them over to the trackmaster.

If the posts carrying these wires are in the ground the contractor shall pull them up. The inspector shall decide and direct what portions of the posts and sills shall be used in the construction of the new fence.

The posts are to be placed not more than sixteen and a half feet apart east and west of Moncton and nineteen feet apart north of Moncton. The posts will be of round cedar, nine feet long and six inches at the small end. They must be well and truly sharpened and have the bark and projecting knots removed from the entire lengths. Wherever practicable they shall be sunk into the ground either by digging holes or driving with large end down to a depth of not less than three and a half feet, and have the earth well tamped around them with a tamping bar.

Where it is not practicable or desirable to sink the posts in the ground, they shall be dovetailed into a sill, which sill shall not be less than eight feet long and six inches in diameter at the small end. Posts shall be braced to sills with cedar braces at least three feet long notched into posts and sills in a workmanlike manner and spiked to both with two six-inch wire spikes at both top and toe of brace, according to sketch. The braces are to be placed on side of the fence next to the track.

The small ends of posts are to be placed uppermost.

The fencing is to be stretched on outside of posts farthest from the track to the satisfaction of the inspector.

The top wire must be secured to each post with two staples, the bottom wire and all intermediate wires must be secured to each post at each intersection with one staple, the staples to be in all cases of number nine gauge wire, and to be not less than two inches long. Straining posts are to be put at gate openings, corners, and other terminations of the fence, and shall in no case be further apart than 1,000 feet. They shall be made according to sketch. The posts shall be sunk into the ground to a depth of not less than four feet, having toggles or anchor pieces well spiked to posts at the bottom, these anchor pieces to be covered with a floor of round cedar and well loaded with stone; corner posts where required shall be braced in both directions. The tops of all posts are to be sawn off to a fairly uniform height. They are to be sawn with square top.

The contractor shall remove the bark from posts, sills and braces, and pile the same on railway land as directed.

The contractor will be required to cut the round cedar to the proper lengths for the posts and braces. In places where directed by the engineer, he will also, on account of the nature of the ground, cut sills in two, frame the posts one foot from the end, and place not less than 100 lbs. of stone on each sill to prevent upsetting.

The contractor will be required to pay the usual current rates for the transport of himself and his men.

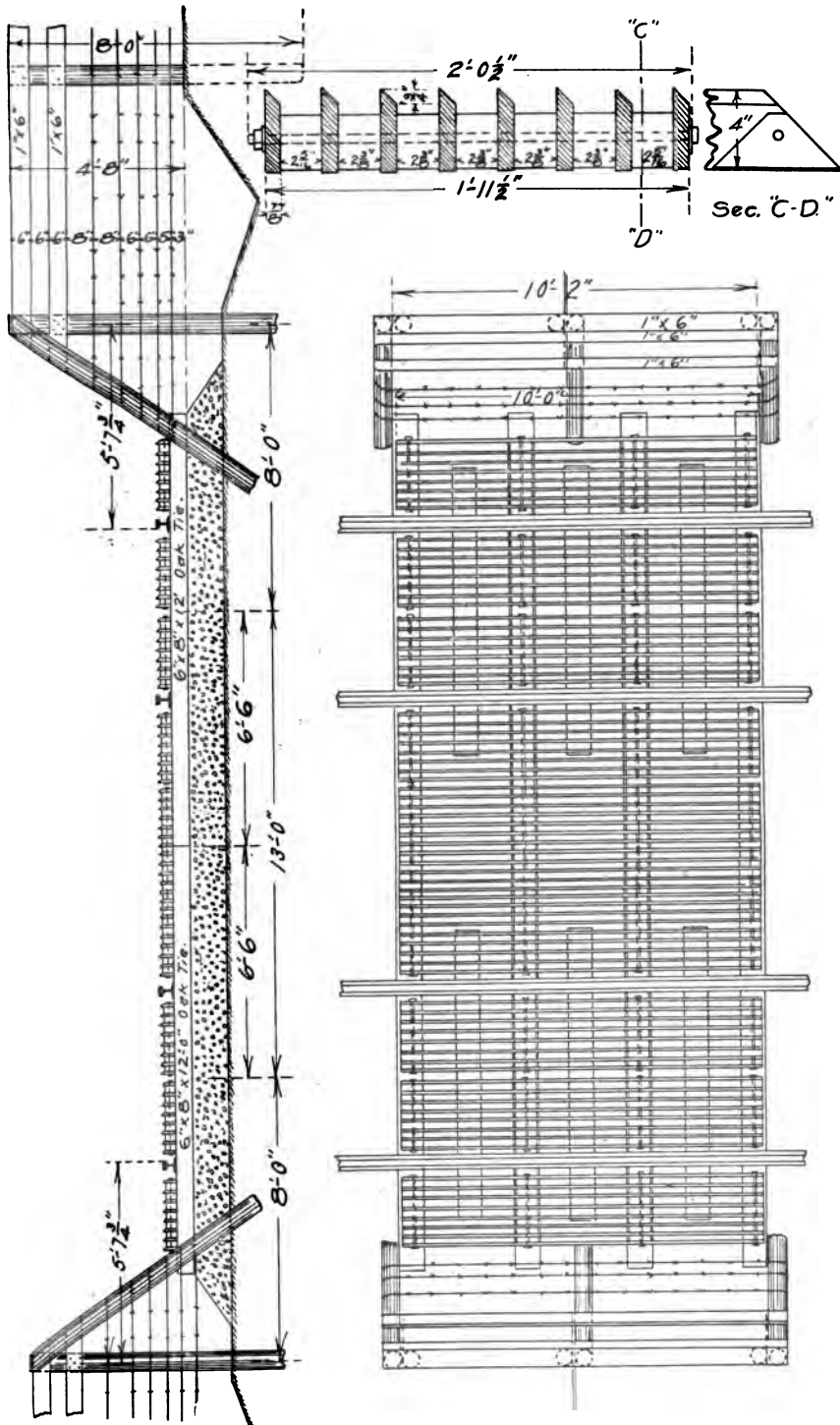


Fig. 16.—C. & N. W. Ry. Lt'd. Surface Cattle Guards.

The railway will transport free of charge all materials for use in the construction of the fence, and will return to the point of shipment free of charges any unused materials left over when the work is completed. The contractor shall load and unload all such materials.

The contractor must take care that animals do not get upon the railway property. He will be responsible for any damage which may occur to the railway department or to others in consequence of the operations of himself or his men or of his or of their neglect.

The railway department will deliver the round cedar as early as possible.

All materials to be supplied by the contractor shall be the best of their several kinds, and shall be subject to the approval of the engineer.

The work shall be completed on or before the.....day of.....
190

The whole work shall be done in a workmanlike manner, and shall be subject to the approval of the engineer.

Payment will be made on the certificate of the engineer, less ten per cent. to be retained until the completion of the contract to the satisfaction of the railway department.

T. C. BURPEE,
Engineer of Maintenance.

J. P. Snow, Bridge Engineer Boston & Maine R. R.:

I beg to submit a design for apron and wing fence at cattle guards that has one feature not shown on any other of the designs submitted to the committee.

The wing fence proper ends with the face of post, seven feet from the rail head. To this is attached, by two-eye bolt hinges, an apron made of one-inch by eight-inch fence boards and an ordinary post cut in two pieces.

The object of this arrangement is to allow the apron to be detached during the snow season, when cattle do not trouble, so as to allow free passage for the side wings of plows.

No special stock is required except the hinges. Squared stock would undoubtedly be better for the apron, but this would mean special stock, which a roadmaster dislikes to carry.

This apron is not standard on the Boston & Maine, but is used on some divisions and seems to have value for a snow-plow region.

The guard shown does not differ much from several others presented with the report. The slats are sawed without waste from round-edge four-inch plank. They are rodded near each end through filler blocks and secured by lag screws to the ties. The apron fences and slat guards are taken up during the winter months and stored in the fence corner, so that no breakage or confusion occurs from removal.

Rock Island System. Specifications for Fencing.

General Clause.—The right of way fencing shall consist of five barbed wires of the Glidden regular galvanized barbed wire, spaced as follows:

Ground to first wire, 6"; between first and second wire, 7"; between second and third wire, 11"; between third and fourth wire, 12"; between fourth and fifth wire, 12".

NOTE.—Height of fence and spacing of wires to conform to the laws of the various states and territories.

The wires shall be attached to posts spaced sixteen and one-half feet center to center. Where cedar posts are used, staples shall be one and three-fourths inches long and where Bois d'Arc or oak posts are used, staples shall be one and one-half inches long.

All panel posts to be seven feet long. Bois d'Arc posts to be not less than three inches in diameter at small end, if round, nor round less than thirteen inches in girth at small end if split. Cedar and oak posts to be not less than five inches in diameter at small end if round, nor less than eighteen inches in girth at small end if split.

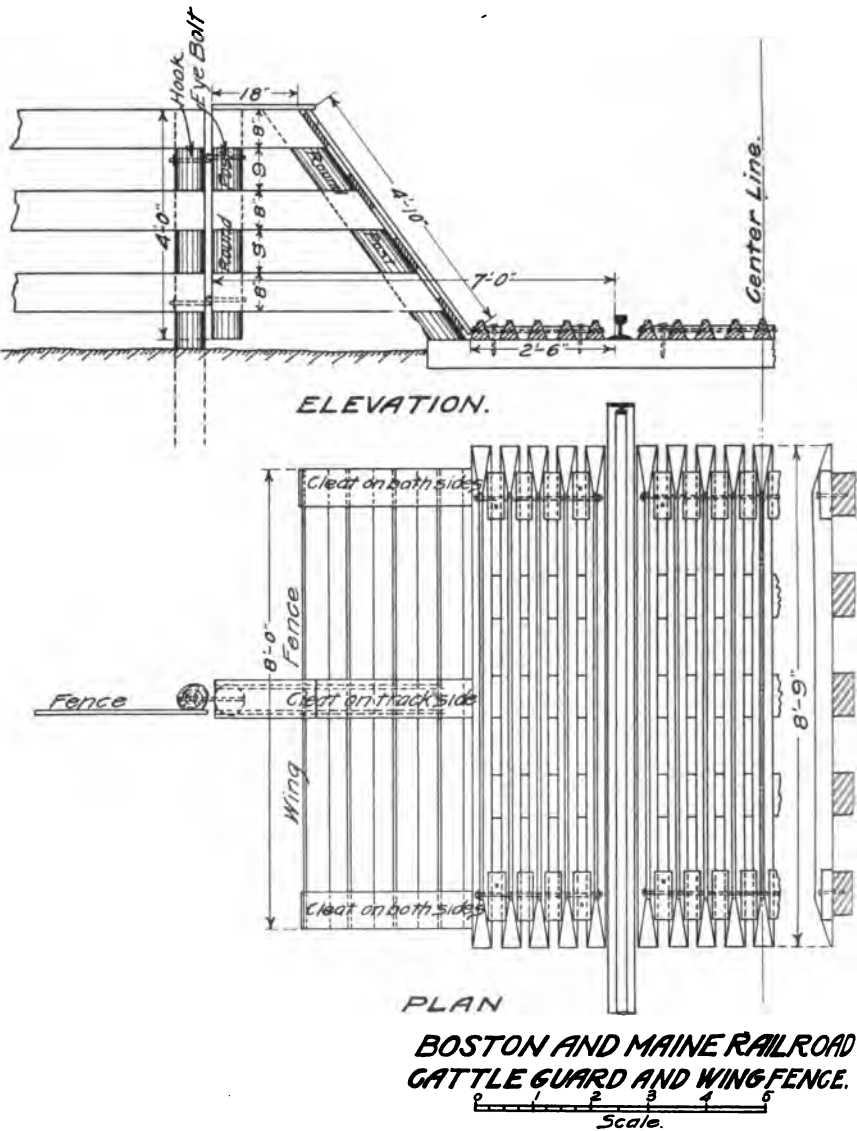
When contractor bids on furnishing all material and erecting fence he shall specify the kind of posts he proposes to furnish, and where they will be delivered to the railway company for distribution. Panel posts are set sixteen feet, six inches apart, center to center, and two feet, six inches in the ground. All holes shall be dug and shall be tamped solid after posts are set. All posts shall be plumb and true to line.

Stretching Wire.—Each wire to be properly stretched and stapled to each post in a first-class manner, with the latest improved tools for doing the work; the fence to be stretched in such a manner as to bring the wires to practically a uniform tension.

Bracing.—All corner ends of fencing, and first panel each way from farm gates to be braced as shown on plan, and braces to be placed at least once in every half mile.

Wing fences and cattle guard fences to be built where designated by the railway company, and to be constructed in accordance with the Rock Island System's standard plan as shown.

Gates to be put in where required by the railway company and as per plan furnished.



**BOSTON AND MAINE RAILROAD
CATTLE GUARD AND WING FENCE.**

FIG. 17.



FIG. 18.—Boston & Maine R. R. Highway Crossing.

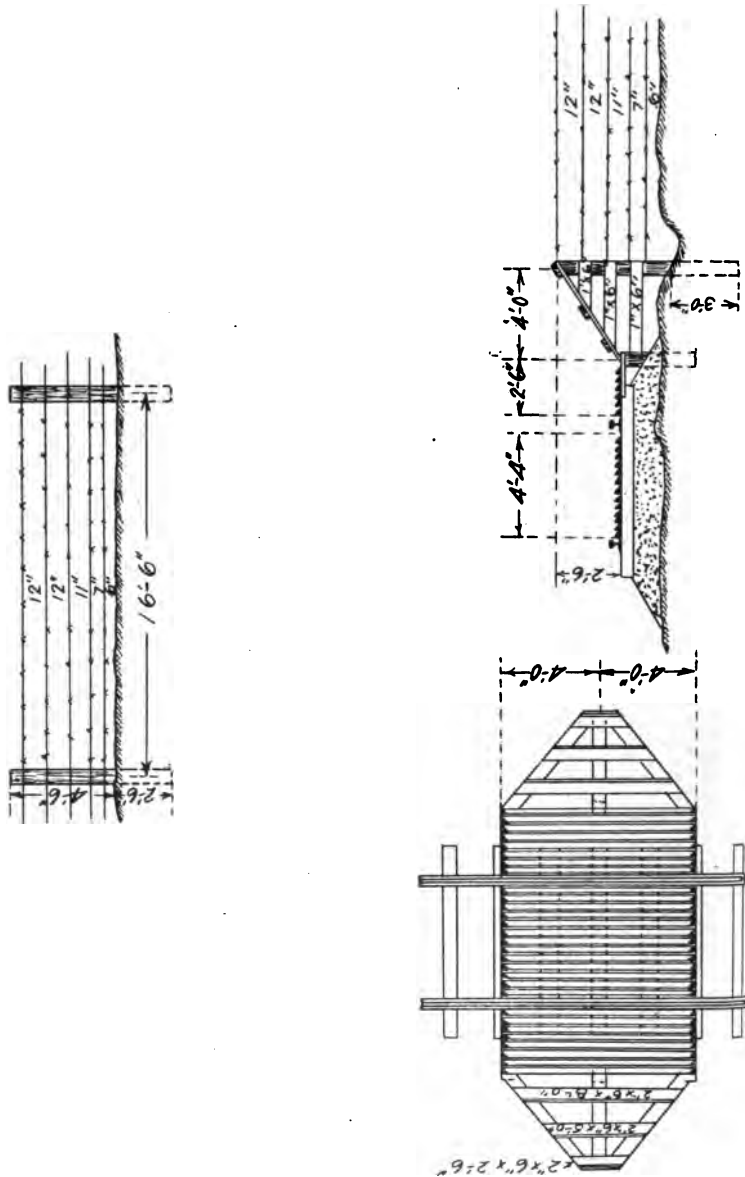


FIG. 19.—C. R. I. System, Fencing and Cattle Guard.
(No Discussion.)

PRESERVATIVES FOR WOOD AND METAL.

(Standing Subject No. 5.)

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

As chairman of your committee on subject No. 5, Preservatives for Wood and Metal, I beg leave to submit the following report:

Not having received any assistance from the other members of the committee, the report is mainly made up from my own experience and observations.

PRESERVATIVES OF WOOD.

As a wood preserver, creosote, no doubt, stands at the head of all other preservatives for piling and timber in railroad construction. On the division where I am located, creosoted piling have been in use to a limited extent for twenty years. When I first became connected with the road here, the company had a creosoting plant at National City on San Diego Bay and creosoted a large number of piles for wharf construction, but after that work was completed, the plant, unfortunately, was abandoned, with only a small surplus of creosoted piling on hand. These were used in bridges and are still in good condition.

In July I inspected a bridge 375 feet long which was re-driven after being washed out in 1889. About one half of the bridge was driven with creosoted piles, and not having creosoted piles of suitable length, the other half was driven with untreated piles, both of Oregon Fir timber. The untreated piles have been renewed once since and must be renewed again this year, while the creosoted piles are in good condition. This shows conclusively what creosote will do for the preservation of wood.

We have used some Arizona Pine timber and piling, also a considerable number of track ties treated with the zinc chloride process, but with us this treatment has not proved to be much of a success.

Salt is a very beneficial wood preserver. Timber that is thoroughly impregnated with salt will resist decay for a long time. This has been proven here by using old piles from wharves that had been standing for a number of years in sea water. These, when driven in bridges on land, have been found to resist decay for more than double the time of that of the plain timber.

In the days of wooden ships, in the shipyards of Maine, it was always the practice to fill all spaces between the timbers in the frame of a ship with salt. A salt stop being put in at the bilge to prevent the salt from going down to the bottom, where it would be dissolved by water in case of leakage. From the salt stop up, every space was filled solid as fast as the planking was put on, even all auger holes made during construction and not filled with

fastening were filled with salt by means of a tin tube and ram-rod. A man called the "salter" was kept employed to carry on this work.

Crude oil has been used on this division during the last ten years on wooden bridges with good results. It has been our practice to apply it liberally to bents and deck. It prevents to a large extent the formation of rotten pockets and checking of timber, as it penetrates the wood instead of forming a surface coat. It also greatly improves the appearance of the structure over raw wood.

The seasoning of timber also adds to its life. It has been proven here that the life of a sawn Douglas Fir cross tie when put in the track green is not over three or four years; while the life of the same, thoroughly seasoned, is about double that time.

It might be interesting to our members, and not out of place, to mention wood that does not need any preservation. This year we renewed some box culverts built of three-inch California Redwood and placed in the fills when the road was built in 1881, giving a life of twenty-six years. These culverts, though considerably decayed, had not collapsed and were still doing service.

A paint manufactured by the Clapp Fire Resisting Paint Company of Bridgeport, Conn., has been favorably brought to my notice as a good wood preserver and protection against fire. I have written several of our members whom I understand have used this paint, asking for a statement as to its merits, but I have received no reply.

PRESERVATIVES OF METAL.

As to metal preservers, I will say that we have used several kinds of paint with varying success, but the best results have been attained with the use of red lead mixed with linseed oil. Much depends upon the quality of the oil; in fact, the oil is the life of the paint. The less the adulteration of the oil the better and more lasting will be the work accomplished. The steel should be thoroughly cleaned and one or two coats of this paint applied. Care must be taken to rub the first coat firmly and uniformly onto the metal when it is dry, leaving no pores unfilled, as the perspiration of the metal will work out on such places and rust will appear. After having established a good base of red lead paint, two coats of any good paint should be applied, of any color to suit the owner. This makes a job that will be the most economical in the long run. It is a mistake after a bridge has been cleaned off for painting to turn the job off with only two coats of paint, and in a year or so to see rust appear through your work.

Red lead is more extensively used, and has been for years, on steel and iron ocean-going ships, as a metal protector than any other paint. Why? Because it makes the best base known. On deck houses, bulwarks, etc., it is usually covered with about four coats of white lead and oil. This makes a protector that salt water spray and sea fog will not easily find its way through.

Following is a copy of a letter that I have received from Mr. J. Wallace, assistant chief engineer of the Southern Pacific Company, in regard to protective paint for steel bridges:

"In reply to yours of the 10th, making inquiry relative to paint for protecting steel bridges along the coast lines. I presume you have reference particularly to structures lying close to the ocean

shore. These bridges are much more difficult to protect, owing to the fogs and moist salt air. We have tested a number of different kinds of paints, many of which have been complete failures.

"In general, we find the best protection is a coat of red lead covered with graphite paint. For bridges in the interior of the state, we use graphite paint only."

Also here are two formulas for asphalt paint which have been used on this coast to some extent, both on wood and metal, with fairly good results:

Asphalt Paint No. 1.

72 lbs. "C" asphaltum.
22 lbs. rosin.
2 gals. boiled linseed oil.
2 gals. turpentine.
10 gals. 63° benzine or gasoline.

Melt asphaltum and rosin at 400° F. Keep at this temperature; after foaming ceases, add oil gradually, stirring after oil is added. Draw fire and cool down to 200° F. and add turpentine and benzine.

Asphalt Paint No. 2.

25 lbs. "C" asphaltum.
2½ lbs. rosin.
6 pints boiled linseed oil.
6 pints 63° gasoline.

Mix same as No. 1. If you don't care for quick drying qualities, use engine distillate instead of 63° gasoline. Where a dip is to be used, use "D" asphaltum at 350° F.

Of course the necessity for good protective paints depends largely upon the atmospheric conditions at the location of a structure. My division extends from the Pacific Coast, where we have the sea fogs and salt moisture to contend with, back into the dry desert country, where there is scarcely a night dew. In the latter location it is an easy matter to protect bridge steel.

W. PARKER,
Chairman.

DISCUSSION.

President.—Have you anything further to say on your subject number five, Mr. Parker?

Mr. Parker.—I believe I have nothing further to say, Mr. President.

Mr. A. S. Markley.—Mr. President, in regard to treated piling and treated timber, I would like to know from those who have handled it in the past whether they know or how they can tell when the treatment has penetrated the timber sufficiently. Is there not some danger about its not

penetrating to the center and that they only get the ingredients in from each end a certain distance. I mean for any kind of timber that has been treated.

Assistant Secretary.—There is a written discussion on this subject that has been handed in here by a gentleman who is not a member of this association, on the preservation of wood. It is signed by Mr. A. Liepold of Milwaukee, Wisconsin.

President.—If there is no objection we will have this discussion read by the assistant secretary in regard to wood preservation.

Written discussion was read by the assistant secretary, as follows:

Gentlemen:

The writer was called upon only yesterday to say something on this subject, and as every one seemed to be interested, I hope you will kindly excuse any lack of elaborateness in my paper.

I do not wish to pose as an authority on this subject, but since the wood preserving business has brought me bread and butter for over twenty years, I ought to know something about it. Furthermore I will confine myself to speaking of such processes as have established their efficiency and practicability. It is not my object to underrate the process generally known as "creosoting," consisting of forcible injection of tar oils into wood; beyond doubt this process accomplishes excellent results, provided it is properly manipulated. A good tar oil must be used,—an oil of a high boiling point from which most of the volatile ingredients have been extracted. Seasoned timber should be used only, because artificial seasoning in the cylinder by superheated steam is liable to take the life out of wood by overheating; in this case it will not hold the spike, its tensile strength being impaired, and ties will become soft and will wear out below the rail before they decay.

I refer to tests made by the Forestry Department, together with the Santa Fé Railway in their Texas experimental track, as shown by Bulletin No. 51 of the Forest Service.

The creosoting process is costly, but the expense is justified for service of wood under severe climatic conditions and provided it is properly executed with suitable material. Climatic conditions must always be considered in choosing a wood-preserved. Thus chloride of zinc treatment may be considered efficient in a dry climate, while in a humid, damp climate this preservative would leach out of the wood before the lapse of its natural life. A combination of both processes is a more effective method. The fact is that railroads in England, Belgium, lower Germany and other moist climates, without exception use a high grade tar oil—not the 9-cents-per-gallon stuff used in this country,—while Austrian, Swiss and Bavarian railways in higher altitudes use chloride of zinc.

Europe, especially Germany, went through the same experience years ago as we are doing now,—scarcity of lumber. They are therefore now ahead of us on the wood-preserving question.

They looked for more practical means to accomplish this end years ago, and I quote from *Scientific American*, November 18, 1901, the following:

"In 1868, Dr. R. Avenarius, a German chemist of note, made a preparation from creosote, which while fairly effective, did not meet with general favor, owing to its inflammability, evaporation and destructiveness to the wood fibre. A few years later Dr. Avenarius invented a coal tar distillation which proved of great merit, *and most of the preservatives now in use are compounded largely in accordance with his formula.*"

As a designation for his preparation, Dr. Avenarius coined the word "Carbolineum," adding his own name to this designation and his compound is now universally known as "Avenarius Carbolineum." From an analytical standpoint and on account of its practical application, it is the standard and ideal wood preserver. Analysis: Flashing point, 145 degrees C.; burning point, 210 degrees C.; distillate below 235 degrees C., 00.44%; distillate between 235 and 300 degrees C., 7.50%; residue above 300 degrees C., 92.1% clear red brown liquid; contents of mineral matter, 00.10%. No separation of naphthaline.

From a practical standpoint, I quote from the very first bulletin issued by the United States Forestry Department. (Bulletin No. 1, 1887.)

"According to F. Engel, imperial government surveyor of buildings, Germany, painting wood with carbolineum as a protection against rot gives favorable results. He confirms this statement in a certificate dated June 19, 1885, stating that woodwork used in underground construction on the imperial roads during the years 1870 to 1885, when painted with carbolineum had no decay up to that date, while unpainted wood was in a rotten state after three years."

I have seen a letter from Mr. Engel dated Berlin, February 8, 1890, in which he further confirms his favorable report to that date. Mr. Engel died during 1892. I quote from a letter from Mr. B. Douglas, formerly building engineer of the Michigan Central Railroad, dated Detroit, Mich., December 16, 1903:

"The carbolineum shipped to Michigan City in October, 1898, was used on posts of a frame trestle where they enter the sand. Timber in these bends not covered with carbolineum has not passed a life of five years, the sand rotting it very quickly. The carbolineum seems to have preserved the timber so far, and I think it probable that it has doubled its life."

Mr. H. Ibsen, his successor, confirms this report under date of January 28, 1907, saying that these posts (with the exception of two) are still in good condition, showing no signs of decay as yet. Copies of these letters no doubt can be obtained through the Carbolineum Wood Preserving Co., Milwaukee.

Now disregarding European opinions of longer standing and even discounting the above statement fifty per cent., does it not pay to use avenarius carbolineum? Tests made by the Forestry Department with the Philadelphia & Reading Coal and Iron Co. on relative cost of preservative treatments, show that an increase of 55

per cent. in life covers cost of creosoting; while an increase of 16 per cent. in life covers cost of the *avenarius carbolineum* treatment. Figuring conservatively that the latter treatment adds 50 per cent. life to wood, there is a clear gain above expense of 35 per cent., ignoring entirely the percentage of gain of costs for labor of replacement and expense and trouble connected with disturbance of roadbed or structure. This is surely a good investment.

From a practical standpoint: *Avenarius carbolineum* is not required to go entirely through the wood; its peculiar chemical ingredients will gradually work into it and cure the wood, in the same manner as smoke cures a ham. It comes ready for use, does not deteriorate nor evaporate, brush remains soft in it, and by heating it, it may be used in winter as well as summer. Its application simply requires a paint brush in the hands of unskilled labor or use by the open tank method. It can be transported to the lumber without trouble and at less cost than transportation of the latter to and from the treating plant. Application may be made most properly under your own supervision. A most excellent feature is that while the application of *avenarius carbolineum* excludes moisture from the wood, air may still enter the wood pores, thus the so-called dry-rot is prevented.

In conclusion I wish to say that the Department of Forestry, U. S. A., deserves unstinted praise for its continuous efforts to ascertain the best means of wood preservation. Tests have been under way for several years on experimental pole lines in every part of the country with different wood preservatives, and results will no doubt be published in due time.

Information on this subject in pamphlet form is furnished by the department to interested parties.

Respectfully submitted,

A. LIEPOLD.
423 29th St., Milwaukee, Wis.

A Member.—In connection with the creosoted timber, would say that we put in a whole new floor system with creosoted lumber in 1902 and it doesn't show any effect from the weather up to this time and the creosote has certainly preserved the lumber very well.

President.—This, gentlemen, is a very important subject, as it deals with the preservatives for wood and metal.

Mr. A. S. Markley.—Mr. President, I do not believe that creosoted timber is any longer an experiment. All railroad companies in the country are investigating the matter, and in conversation with one of our members, Mr. Schall, he informed me that he put up a coal dock that is now twenty-six years old and the lumber is just as good today as the day it was creosoted, with the exception of the wear and tear of the floor itself. It is the very best preservative.

We have just started this year receiving and using creosoted timber and we expect of course good results. There are perhaps members here, however, who have used this for a number of years and who can probably give us some valuable information upon the subject.

Mr. Staten.—We use a great deal of creosoted piling and timber of different kinds, but the only way to use creosoted timber is to have it framed and bored and everything ready before you creosote it. Now we get creosoted piles and drive them and they are cut off below where they are creosoted. The Louisville and Nashville R. R. frame and bore all holes before it is creosoted, and that is the only way to use creosoted lumber.

Mr. A. S. Markley.—I think Mr. Staten is right. Our contract calls for the creosoted timber and a guarantee of twelve pounds to the cubic foot.

Mr. W. O. Eggleston.—About five years ago we put in a scale on the New York division of the Erie railroad. We used all creosoted timber and some was twelve to sixteen-inch timber. It had all been penetrated entirely through and in working up that timber in various ways there was not any part that did not show the liquid preparation; and I would also feel safe to say that it will last there a great many years and it is in the worst place there is to keep timber.

President.—Has anyone else anything more to say on the subject?

Mr. Perry.—On the Reading railroad we have used quite a number of creosoted piles. Some of them were driven sixteen or seventeen years ago and some, put in five years ago, which were not creosoted, have become very much decayed. On a recent bridge inspection tour, we found that all of the creosoted piling was perfectly sound, but I cannot say how much longer they will last. The foreman on this division said that when they were cut off they were creosoted nearly all the way through the stick.

Mr. A. S. Markley.—Was the soil condition the same in both cases?

Mr. Perry.—Yes, the soil was, as you understand, near Atlantic City, very soft and mucky, and the soil conditions were the same in both cases.

Mr. Parker.—Some member spoke of piling being creosoted clear through the entire stick. I would like to know what kind of timber was used.

Mr. Perry.—The creosoted timber that I am speaking of was long leaf yellow pine.

Mr. Canty.—I notice that quite an effective way of preserving timber on bridges from the effects of the weather is to plane sticks on sides exposed to weather and paint the planed sides. Considerable benefit may be derived by just this simple process.

Mr. A. S. Markley.—My understanding is that creosoting is to go through the timber and if not, the result will not be satisfactory.

Mr. Parker.—I have never had any experience with creosoted timber, excepting Oregon pine or Douglas fir, and I never saw any creosote that would penetrate any piling over two inches. It has hard growth rings and it is almost impossible to get through those hard rings with creosote. We have creosoted piling that has been in use twenty years and not begun to rot yet. I couldn't remember how far the creosote penetrated into those pilings, but I don't imagine over two inches at the most. We never creosote any stringers or bridge ties. It seems to me that would not be a good thing to do, because the process weakens the timber considerably; but in ballast-decked trestles all the decked timber is creosoted and timber enough is put in to make up for the weakening effect of the creosoting process.

Mr. Killam.—On the Intercolonial railway system we use creosoted piling for wharves and docks at the various terminals of our system. The piling is creosoted according to the government specification, which I think is fifteen pounds to the foot, and a man is often sent to inspect it

while it is being done. I have seen piles where we have had to cut a piece off on account of being too long, where they were creosoted not over two and one quarter inches deep. They were sixteen inches to eighteen inches through and would be creosoted may be two and one quarter inches, and the center of the piling would be just the same as if there had never been any creosoting, and I have seen some piles creosoted that way that have been in use twenty-six years and the piles are apparently as good above the water as they were when put in. No sign of rot in any part of them.

Mr. A. S. Markley.—How far from the end were the piling cut that you speak of?

Mr. Killam.—About seven or eight feet from the end.

Mr. Harwig.—For the benefit of the members I would state that we have used considerable yellow pine piling, creosoted in sizes from twelve to fifteen inches or over at the butt, and six to eight inches or over at the point, and from thirty to seventy feet in length.

We have one freight dock that was built entirely of creosoted timber, except the decking, which was untreated. This dock was built about twenty-five years ago. We have renewed the decking at least three times. We have had occasion to pull some of the piling from the foundation, in making alterations in the last year and found them to be just as good as the day when they were put in. The creosote had not penetrated through the entire timbers in all cases, but creosote or oil of tar can be forced entirely through almost any ordinary piece of timber; it depends altogether on how much expense is desired.

Mr. W. O. Eggleston.—If any of the members are present who attended the meeting in Boston last year they will remember the samples which Mr. Cummin brought to the meeting, which showed the penetration of the creosote through the entire pile, and I personally know that it penetrated the timbers in the scales. Some were twelve by sixteen inch timbers. This was yellow pine and about sixteen

pounds of creosote was used. We bought the timber already creosoted.

Mr. Penwell.—I have had no experience with creosoted piling, but I had a little with timber in the recent track elevation at Indianapolis, and if I am not mistaken the specifications were only twelve pounds to the foot and this lumber varied in length from sixteen to twenty feet, and it is laid diagonally across the bridge. We had occasion to cut a number of the pieces in the middle and we found in every case this material, where it was cut in the middle, was thoroughly saturated, except a little round spot in the center, but the balance of the stick was thoroughly saturated wherever we had occasion to cut it.

Mr. Sibley.—I would like to inquire of some one who has had considerable experience in creosoting if they will kindly give the approximate cost per thousand for treating timber in this way, that is, eight by sixteen stringers or twelve by fourteen caps, etc.

Mr. W. O. Eggleston.—They cost us \$40 a thousand creosoted. That includes everything.

Mr. Harwig.—The cost of the treatment depends altogether on how much dead oil of coal tar is forced per cubic foot into the timber that is being treated. Of course, the cost of this varies in different parts of the country, and I am not prepared at this time to give a statement as to the exact cost.

Mr. Parker.—Yes, we have used a good deal of the crude oil on our bridges.

Mr. Penwell.—I like the preparation that is sold here in Milwaukee, although I am not talking for Milwaukee, but from personal experience *avenarius carbolineum* is a wood preservative that I am very much in favor of. In regard to this matter of crude oil that Mr. Eggleston has mentioned, we have had similar experiences. The piling in our country usually lasts from eight to twelve years, but very seldom lasts twelve years. But we have had some piling that has become coated with crude oil floating on

the streams by the rising and falling of the water, and wherever this crude oil has come in contact with the piling, the piling has been protected greatly by it. I am thoroughly satisfied in my mind that crude oil is almost equal to any fluid for an outside application. The carbolineum, however, is doing good work for us.

Mr. Clark.—I was employed for several years in the oil fields and I know that anything saturated with crude oil is perfectly preserved. I also know that crude oil is a very inflammable article, and I doubt the propriety of soaking any bridge timber with crude oil. While it is a perfect preservative from rot, something powerful will be needed to preserve it from fire.

Mr. Penwell.—I was not going to use crude oil for this purpose because I understand that the danger from fire would prohibit its use.

Mr. Parker.—We have been using crude oil for about ten years on our bridges. The timber above the ground is given a heavy coat, and we have never considered that this added anything to the fire risk. Of course, when the crude oil is first applied, it might be more liable to take fire, but it immediately soaks into the wood and the dust gets all over it, and we have never considered that there was any more risk in the timber burning from the use of the crude oil than without it. In fact we have had several bridges that took fire that had been coated with crude oil and there is no more trouble in extinguishing it than with ordinary timber.

Mr. Reid.—In connection with creosoting, which is without doubt a live subject, I would like to ask any members who have had experience in the use of creosote if the timber should not be penetrated clear through the stick. If it is only creosoted part way through, the question arises whether it would not rot inside or cause heart rot, and is it practicable in all ordinary sizes of timber to creosote it clear through the timber?

Mr. Harwig.—I wish to say that we at the present time are remodeling one of our docks on the New York harbor, which was built about twenty-five years ago, in the construction of which we used creosoted "yellow pine piling"; upon removing some of these we found them in as good a condition as the day they were put in place, twenty-five years ago.

In some cases the creosote had penetrated through the entire pile; in others only part way, from four to five inches at the butt, and leaving the center of the pile untreated. Our experience is that the toredo does not attack creosoted piling, neither do they show any sign of rot after twenty-five years or more of service.

Mr. Joslin.—Above or below the water line?

Mr. Harwig.—Both above and below the water line they show no signs of either rot or the toredo having affected them.

President.—Has any other member anything more to say?

Mr. A. S. Markley.—I should like to hear from Mr. Schall in regard to treated timber.

President.—Mr. Schall, we would be glad to hear from you. We are discussing preservatives for wood and metal.

Mr. Schall.—The Lehigh Valley Railroad Company used creosoted timber in the construction of a large coal dock at Perth Amboy, N. J. This dock was constructed during 1886 and the timber is as good today as when it was placed. No deterioration of any kind, and no repairs are required on account of decay of timber.

Mr. A. S. Markley.—Just one question,—is the timber creosoted the entire length and through the entire stick?

Mr. Schall.—As a rule the creosote or dead oil of coal tar does not penetrate the whole stick; it depends upon how many pounds of creosote oil are used per cubic foot of timber; the slow growth, close grained, harder timber will not take as much as the softer or fast growth timber.

For the fast growth yellow pine timber, the creosote oil will penetrate through the whole stick, while for the slow growth yellow pine, it will generally not penetrate through the whole stick.

The sap is first deducted from the timber by steam pressure, after which the pores left by the sap are filled by forcing creosote (dead oil of coal tar) into the timber.

Mr. Eggleston.—This discussion has been carried on entirely in regard to preserving the timber. The subject, however, I believe mentions metals. I think that is an important matter, and I would like to hear something along that line.

A. S. Markley.—In order to get best results, buy the best paint on the market, paint as often as necessary and do not allow the structures to rust. The cost of paint is not the greatest expense, when it costs from \$1.50 to \$3.50 per gallon to spread it. A large amount of money can be saved, as well as structures preserved if proper methods are maintained. Paint does not always fail and iron corrodes over the entire surface of the structure at the same time. In some cases (depending on location) in the same structure, paint will last fifteen to twenty years; in other places only four or five years. Usually the surface exposed to the sun, or underneath web members of lower cords, truss or track stringers over streams, will depreciate more rapidly than other surfaces. By touching these places over with paint after cleaning, the cost of painting structures will be reduced at least fifty per cent. Girders usually require less care in painting than any other class of structures on account of their protection from the elements by the track or deck.

Mr. W. O. Eggleston.—I would like to know just what the best paint is, and what the result has been with it.

Mr. Penwell.—Speaking in regard to preserving iron, in our experience, it is generally considered the best thing to repaint. We receive iron with some sort of a shop coat on, but we always repaint it. Repainting is of more import-

ance to us than the first application. I think in preserving metal the first and most important thing to do is to clean it thoroughly. It is useless to apply any paint on a lot of rusty scales and expect good results. I think the most important thing and the thing that is overlooked by some railroads is the matter of properly cleaning the iron. I daresay we spend more money in cleaning iron bridges, turntables, etc., than in applying the paint. It is most important to get the iron in condition to apply the paint. I think that there was never anything (with all due respect to the paint firms here represented) made that is better than red lead for iron. It has been the most satisfactory thing that I have ever used. We have used some other paints, and many good paints, but I prefer red lead. I would not want to discuss any particular kind of paint, but I will state that I have had experience with some and with very good results; but I naturally go back to the red lead. When the iron is properly cleaned and painted with pure red lead, you have got the best thing on the market, or that can possibly be obtained.

COMMITTEE REPORTS

FOR 1907 AND 1908.

PRESENTED AT THE SEVENTEENTH ANNUAL
CONVENTION, MILWAUKEE, WIS.,
OCTOBER, 1907.

I.
EXPERIENCE IN CONCRETE BRIDGES, ARCHES
AND SUBWAYS.

(*No report and no discussion.*)

II.
CONCRETE BUILDINGS.
REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Concrete building construction can be divided into four classes:

Solid heavy walls;

Solid light walls reinforced with rods;

Building blocks made with machines for that purpose, having hollow spaces at intervals throughout the wall;

A wall constructed with metal lath plastered with a Portland cement mortar.

The objections to solid walls for building purposes are the following:

Liability to crack;

Expense on account of forms; and

Dampness seeping through the wall.

The last two of these objections are found in reinforced concrete walls. Cracks, however, are not liable to develop in this construction because of the reinforcement.

These objections may be overcome if proper precautions are taken in the construction. The dampness of the walls may be overcome by painting the exterior surface with a waterproofing compound. There are many of these on the market today which answer the purpose admirably and give the surface of the building a nice and even appearance.

In constructing buildings of solid concrete, pilasters should be built separately as columns with anchor rods projecting from them, and the intervening wall built between after the pilasters have hardened so as to make a joint at intervals in the concrete. Where reinforced concrete is used, these joints are not necessary, and, in fact, not desirable as the wall should be built as a unit.

The forms are an expensive item in both these kinds of construction, but their cost can be largely reduced by making a standard section which can be used many times throughout the construction of the building. As the appearance of the building is one of the essentials, forms should be constructed so that a tier of the building may be completed in one day and the forms from that tier moved after twenty-four hours and used for each succeeding tier. In this way the face of the concrete can be treated or patched successfully while green without marring the outside face.

To overcome the objections to the above, many advocate the use of the concrete building block, and there are a large number of different makes of machines on the market for molding them. These blocks are provided with a hollow space so as to prevent the moisture from reaching the inside of the building. There are the following objections to the use of these blocks:

It is very difficult to form them without there being some blemish on the surface, and which it is impossible to properly remedy.

The molded blocks never have the sharp outlines which are necessary for good appearance.

The construction of blocks must be very carefully watched, otherwise, through the incompetence of the workmen or dishonesty of the maker, a very small amount of cement is used in their composition, with the result that they are very fragile and readily broken. Several cases have occurred where buildings built of blocks have fallen down of their own weight on account of the "lean" mixture used in the make-up of the blocks.

Most of these blocks are very porous because of the fact that they have to be made with a dry mixture. Only those blocks should be used that can be made with a wet mixture and pressed with great power, and all blocks made by hand tamping with dry mixture should never be used.

The last form of construction named: namely, plaster on expanded metal, is cheap and answers the purpose satisfactorily for all kinds of shop buildings and for cheap small buildings. This construction, however, has been used with success for elaborate buildings in California and the Southern states, and many beautiful residences are being built today by this method. It consists of a framework of wood or steel, with metal lath attached to the outside surface, which is coated with mortar on both sides, forming an exterior wall over an inch and a half in thickness. On the interior surface of the framework, metal lath may also be attached and plastered on the inside. Thus in this latter construction a hollow wall is formed with an air space which affords perfect protection against dampness and is a good insulator for heat and cold. The outer face of the exterior wall is usually coated with a water-proofing compound. This form of construction permits of elaborate details at small expense.

As one of the most important things in concrete work is a specification, and as there seem to be so few of this nature, the following specifications will be found useful:

CONCRETE.

Crushed Stone.—Crushed stone shall be preferably limestone or other good hard stone, subject to the approval of the chief engineer, and shall be angular and clean, well graded in size and shall be small enough at its longest dimension to pass through a ring two inches in diameter, and shall be practically free from dust produced by the crusher.

Gravel.—Gravel must be coarse and well screened, free from clay, loam or any other objectionable matter, and the maximum size shall be as specified for crushed stone.

Sand.—Sand must be free from loam or any other objectionable matter, but may contain an amount of clay not to exceed five per cent., and shall be sharp, coarse and well screened.

Cement.—Cement shall be as defined as Portland Cement in the standard specifications adopted June 14, 1904, by the American Society for Testing Materials. Samples for testing shall be furnished the chief engineer at least two weeks before the cement

is used. All cement shall be delivered in suitable packages bearing the name of the manufacturer and the brand of cement.

Mixing and Placing.—The material shall be mixed in the following proportions: Cement, one sack of not less than 90 lbs. net; sand, $2\frac{1}{2}$ cu. ft.; broken stone or gravel, 5 cu. ft. The consistency shall be what is known as a "wet mix," but not wet enough to cause separation of the cement from the mixture on the board or in the forms. All concrete must be tamped and all surfaces, especially those which will be exposed upon the removal of the forms, must be thoroughly spade finished so that there will be no voids on the surfaces.

When mixed by hand the stone or gravel shall be thoroughly wet with water. The cement and sand shall be mixed and tempered with water and spread on the platform, the wet stone or gravel placed on the same, and the whole mass thoroughly mixed until the cement is uniformly distributed throughout. In wetting the mixture of sand and cement to make the mortar and in wetting the mixture of stone or gravel, sand and cement, the water must not be dashed upon the same from buckets or in large quantities.

Hand mixed concrete will only be permitted in unimportant work.

Thickness of Layers.—Concrete shall be placed in layers not exceeding 12 inches in thickness and all courses must be kept level.

Joints in Layers.—All joints caused by the temporary stopping of work on a course or courses must be vertical or level. The vertical joints are to be gained by securing bulkheads or cross-planks in the forms against the concrete the same as on all other sides of the forms. Bulkheads to be removed when work is next commenced.

Cleaning and Grouting the Layers.—Wherever fresh concrete joins concrete that has set, the surface of the latter shall be roughened and thoroughly cleaned and the thin skin on top removed. Wherever it will be above the ground, or when the chief engineer directs, the surface shall be slushed with cement grout in addition to the above. Grout to consist of cement and water.

REINFORCED CONCRETE.

(Embodied in the Building Ordinances of the City of St. Louis.)

1. Reinforced concrete is a concrete in which steel is embodied in such manner that the two act in unison in resisting stresses due to external loading.

2. Concrete is an artificial stone resulting from a mixture of Portland cement, water and an aggregate.

3. Portland cement shall be as defined in the Standard Specifications adopted on June 14, 1904, by the American Society for Testing Materials.

4. An aggregate, as herein used, means one or more of the following materials: Sand, broken stone, gravel, hard burned clay. Aggregates will be divided into two classes, fine aggregates and coarse aggregates. A fine aggregate will include all aggregate passing a No. 8 sieve; a coarse aggregate will include all aggregate passing a 1 inch ring and retained on a No. 8 sieve.

5. Portland cement shall conform to the requirements of the

specifications of the American Society for Testing Materials, as adopted June 14, 1904, with all subsequent amendments thereto.

6. Aggregates. Fine aggregates shall be well graded in size from the finest to at least the size retained on a No. 10 sieve. Coarse aggregates shall also be well graded in size, from the finest to at least the size retained by a 9-16ths inch ring. Fine aggregates may contain not more than 5 per cent., by weight, of clay, but no other impurities. Coarse aggregates shall contain no impurities.

7. Sand shall be equal in quality to the Mississippi River sand.

8. Broken stone shall be either limestone, chatts or granite, or some other stone equal to one of these in the opinion of the chief engineer.

9. Hard burned clay shall be made from suitable clay free from sand or silt, burned hard and thoroughly. Absorption of water should not exceed 15 per cent.

10. Concrete. The solid ingredients of the concrete shall be mixed by volume in one of the following proportions:

(a) Not more than three parts fine aggregate to one of cement.

(b) Not more than two parts of fine aggregate and four parts of coarse aggregate to one of cement; but in all cases the fine aggregate shall be 50 per cent. of the coarse aggregate.

11. Concrete shall have an ultimate strength in compression in twenty-eight days of not less than the following:

Burned clay concrete—1,000 pounds per square inch.

All other concrete—2000 pounds per square inch.

12. Steel shall be Medium Steel or High Elastic Limit Steel. The physical properties shall conform to the following limits:

	<i>Medium Steel.</i>	<i>High Elastic Limit Steel.</i>
Elastic Limit,	Not less than 30,000	Not less than 50,000
Percentage of Elongation, Min. in 8"	$E = \frac{180,000}{f-10,000} - 10$	$E = \frac{180,000}{f-10,000} - 10$
Cold bend without fracture on outer circumference 180 deg. flat.		90 deg. to radius = 5 times thickness
Character of fracture,	silky	silky or fine granular
f = unit stress in steel at ruptures.		

13. Tests shall be made on specimens taken from the finished bar, and certified copies of test reports shall be furnished the Chief Engineer at his request.

14. Bending tests shall be made by pressure.

15. Finished material shall be free from seams, flaws, cracks, defective edges or other defects, and have a smooth, uniform and workmanlike finish, and shall be free from irregularities of all kinds.

16. The net area of cross-section of finished steel members shall not be less than ninety-five per cent (95%) of the area shown in the approved design.

17. All reinforced concrete work shall be built in accordance with approved detailed working drawings. These drawings shall be submitted to the Chief Engineer for approval and no work

shall be commenced until the drawings shall have been approved by him.

18. The steel used for reinforcing concrete shall have no paint upon it, but shall present only a clean or slightly rusted surface to the concrete. All dirt, mud and other foreign matter shall be removed.

19. If the steel has more than a thin film of rust upon its surface it shall be cleaned before placing in the work.

20. In proportioning materials for concrete, one bag containing not less than 93 pounds of cement, shall be considered one cubic foot.

21. The ingredients of the concrete shall be so thoroughly mixed that the cement shall be uniformly distributed throughout the mass and that the resulting concrete will be homogeneous.

22. The concrete shall be mixed as wet as possible without causing a separation of the cement from the mixture, and shall be deposited in the work in such manner as not to cause the separation of mortar from coarse aggregate.

23. Concrete shall be placed in the forms as soon as practicable after mixing, and in no case shall concrete be used if more than one hour has elapsed since the addition of its water. It shall be deposited in horizontal layers not exceeding eight inches in thickness and thoroughly tamped with tampers of such form and materials as the circumstances require.

24. The steel shall be accurately placed in the forms and secured against disturbance while the concrete is being placed and tamped, and every precaution shall be taken to insure that the steel occupies exactly the position in the finished work as shown on the drawing.

25. Before placing of concrete is suspended the joint to be formed shall be in such place and shall be made in such manner as will not injure the strength of the completed structure.

26. Whenever fresh concrete joins concrete that has set, the surface of the old concrete shall be roughened, cleaned and thoroughly slushed with a grout of neat cement and water.

27. No work shall be done in freezing weather, except when the influence of frost is entirely excluded.

28. Until sufficient hardening of the concrete has occurred, the structural parts shall be protected against the effects of freezing, as well as against vibrations and loads.

29. When the concrete is exposed to a hot or dry atmosphere special precautions shall be taken to prevent premature drying by keeping it moist for a period of at least twenty-four hours after it has taken its initial set. This shall be done by a covering of wet sand, cinders, burlap, or by continuous sprinkling, or by some other method equally effective in the opinion of the Chief Engineer.

30. If during the hardening period the temperature is continually above 70 deg. F., the side forms of concrete beams and the forms of floor slabs up to spans of eight feet shall not be removed before four days. The remaining forms and supports not before ten days from the completion of tamping.

31. If during the hardening period the temperature falls below 70 deg. F., the side forms of concrete beams and the forms of floor slabs up to spans of eight feet shall not be removed before

seven days; the remaining forms and the supports not before fourteen days from the completion of the tamping. But, if, during the hardening period, the temperature falls below 35 deg. F., the time for hardening shall be extended by the time during which the temperature was below 35 deg. F.

32. Forms for concrete shall be sufficiently substantial to preserve their accurate shape until the concrete has set, and shall be sufficiently tight so as not to permit any part of the concrete to leak out through cracks or holes.

33. Before placing the concrete, the inside of the forms shall be thoroughly cleaned of all dirt and rubbish, the forms of all beams, girders and columns being constructed with a temporary opening in the bottom for this purpose.

34. If loading tests are considered necessary by the Chief Engineer, they shall be made in accordance with his instructions, but the stresses induced in all parts of a structural member by its test load shall be the same as if the member were subjected to twice the dead load plus twice the assumed load.

35. All tests of material herein required shall be made by testing laboratories of recognized standing, and certified copies of such test reports shall be filed with the Chief Engineer.

36. The weight of burned clay concrete, including the steel reinforcement, shall be taken at 120 lbs. per cu. ft.

37. The weight of all other concrete, including the reinforcement, shall be taken as 150 lbs. per cu. ft.

38. Besides the above, in calculating the dead loads, the weights of the different materials shall be assumed as given in Table No. 1.

TABLE No. 1.

Weights of Building Materials, etc., in Pounds per Cubic Foot.

<i>Material.</i>	<i>Weight.</i>	<i>Material.</i>	<i>Weight.</i>
Paving brick,	150	Plaster,	140
Building brick,	120	Glass,	160
Granite,	170	Snow,	40
Marble,	170	Spruce,	25
Limestone,	160	Hemlock,	25
Sandstone,	145	White pine,	25
Slag,	140	Oregon fir,	30
Gravel,	120	Yellow pine,	30
Slate,	175	Oak,	50
Sand, clay and earth,	110	Cast iron,	450
Mortar,	100	Wrought iron,	480
Stone concrete,	150	Steel,	490
Cinder concrete,	90	Paving asphaltum,	100

39. The following table gives the uniformly distributed live loads for which structural members shall be designed when their dead loads are as given in the first column A:

TABLE No. 2.

DEAD LOAD. Pounds per Square Foot.	CORRESPONDING LIVE LOAD. Pounds per Square Foot.			
(Column A)	(1)	(2)	(3)	(4)
40 or under.....	72	103	155	194
50	63	93	140	195
60	59	84	126	158
70	53	76	114	143
80	48	69	104	130
90	46	64	96	120
100	41	58	87	109
110	37	53	80	100
120	34	49	74	93
130	31	44	66	81
140	29	41	62	78
150 or over.....	27	39	59	74

40. The live loads on floors for dwellings, apartment houses, dormitories, hospitals and hotels shall be as given in column (1) of Table No. 2.

41. For schoolrooms, churches, offices, theater galleries, use column (2) Table No. 2.

42. For ground floors of office buildings, corridors and stairs in public buildings, ordinary stores, light manufacturing establishments, stables and garages, use column (3) Table No. 2.

43. For assembly rooms, main floors of theaters, ball rooms, gymnasiums or any room likely to be used for dancing or drilling, use column (4) Table No. 2.

44. For sidewalks, 300 pounds per square foot.

45. For warehouses, factories, special according to service, but not less than column (4) of Table No. 2.

46. For columns the specified uniform live loads per square foot shall be used with a minimum of 20,000 pounds per column.

47. For columns carrying more than five floors the live loads may be reduced as follows:

For columns supporting the roof and top floor, no reduction.

For columns supporting each succeeding floor, a reduction of 5 per cent. of the total live load may be made until 50 per cent. is reached, which reduced load shall be used for the columns supporting all remaining floors.

48. This reduction is not to apply to live load on columns of warehouses, and similar buildings which are likely to be fully loaded on all floors at the same time.

49. The method used in computing the stresses shall be such

that the resultant unit stresses shall not exceed the prescribed unit stresses as computed on the following assumptions:

(1) That a plane section normal to the neutral axis remains such during flexure, from which it follows that the deformation in any fibre is directly proportionate to the distance of that fibre from the neutral axis.

(2) That the modulus of elasticity remains constant within the limits of the working stresses fixed in these regulations and is as follows:

Steel, 30,000,000 lbs. per square inch.

Burnt clay concrete, 1,500,000 lbs. per square inch.

All other concrete, 2,000,000 lbs. per square inch.

(3) That concrete does not take tension, except that in floor slabs, secondary tension induced by internal shearing stresses may be assumed to exist.

50. The allowable unit stresses under a working load shall not exceed the following:

Burnt clay concrete:

Direct compression, 300 lbs. per square inch.

Cross bending, 400 lbs. per square inch.

Direct shearing, 150 lbs. per square inch.

Shearing where secondary tension is allowed, 15 lbs. per square inch.

All other concretes:

Direct compression, 500 lbs. per square inch.

Cross bending, 800 lbs. per square inch.

Direct shearing, 300 lbs. per square inch.

Shearing where secondary tension is allowed, 25 lbs. per square inch.

STEEL.

	Medium Steel.	High Elastic Limit Steel.
Tension,	14,000	20,000

51. The compression in the steel shall be computed from the corresponding compression in the concrete, except for hooped columns.

52. The bonding stress between steel and concrete under working load shall not exceed the following for plain steel:

For medium steel, 50 lbs. per superficial sq. in. of contact.

For high El. Lim. steel, 30 lbs. per superficial sq. in. of contact.

53. For bars of such shape throughout their length that their efficiency of bond does not depend upon the adhesion of concrete to steel, the allowable bonding stress under working load shall be determined as follows:

The bars shall be imbedded not less than six inches in concrete as herein defined, and the force required to pull out the bar shall be ascertained. At least five such tests shall be made for each size of bar and an affidavit report of the test shall be submitted to the Chief Engineer, who shall then fix one-fourth of the average stress thus ascertained at failure as the allowable working stress.

54. The unsupported length of a column shall not exceed fifteen times its least lateral dimension.

55. In a column subjected to combined direct compression and

flexure, the extreme fibre stress resulting from the combined actions shall not exceed the unit stress prescribed for direct compression.

56. All columns shall have longitudinal steel members so arranged as to make the column capable of resisting flexure. These longitudinal members shall be stayed against buckling at points whose distance apart does not exceed twenty times the least lateral dimension of the longitudinal member. In no case shall the combined area of cross-section of these longitudinal members be less than one per cent. of the area of the concrete used in proportioning the column, and the stays shall have a minimum cross-section of three one-hundredths of a square inch (0.03) sq. ins.

57. If a concrete column is hooped with steel near its outer surface either in the shape of circular hoops or of a helical cylinder, and if the minimum distance apart of the hoops or the pitch of the helix does not exceed one-tenth the diameter of the column, then the strength of such a column may be assumed to be the sum of the following three elements:

(1) The compressive resistance of the concrete when stressed not to exceed five hundred pounds per square inch for the concrete enclosed by hooping, the remainder being neglected.

(2) The compressive resistance of the longitudinal steel reinforcement when stress does not exceed allowable working stress for steel in tension.

(3) The compressive resistance which would have been produced by imaginary longitudinals stressed the same as the actual longitudinals; the volume of the imaginary longitudinals being taken at two and four-tenths (2.4) times the volume of the hooping. In computing the volume of the hooping it shall be assumed that the section of the hooping throughout is the same as its least section. If the hooping is spliced the splice shall develop the full strength of the least section of the hooping.

58. The minimum covering of concrete over any portion of the reinforcing steel shall be as follows:

For flat slabs, not less than one inch.

For beams, girders, ribs, etc., not less than one and one-half inches.

For columns, not less than two inches. In computing the strength of columns, other than hooped columns, the outside one inch around the entire column shall be neglected.

59. For flat slabs continuous over two or more supports and uniformly loaded, the bending moment may be taken as $\frac{WL}{12}$ in which W equals total load on the span and L the center to center distance between supports.

60. Beams continuous over supports shall be reinforced to take the full negative bending moment over the supports, but shall be computed as non-continuous beams.

61. The minimum distance center to center of reinforcing steel members shall not be less than the maximum diameter or diagonal dimensions of cross-section plus two inches.

62. In designing T-beams, the width of floor slab which may be assumed to act as compression flange of the beam, shall not

exceed one-fourth ($\frac{1}{4}$) of the span of the beam, but in no case shall it exceed the distance, center to center, of beams.

63. If it is necessary to splice steel reinforcing members, either in compression or tension, the splice shall be either a steel splice that in tension will develop the full strength of the member, or else the members shall be lapped in the concrete for a length equal to at least the following: For plain bars of medium steel, forty times the diameter or maximum diagonal of cross-section. For plain bars of high elastic limit steel, seventy times the diameter or maximum diagonal of cross-section. For other than plain bars, the length of lap shall be in inverse ratio to the ratio of the allowed bonding stresses as herein required. In no case, however, shall the steel reinforcement in a beam or girder be lap spliced.

CONCRETE BUILDING BLOCKS.

(Embodied in the building ordinances of the city of Philadelphia.)

1. Hollow concrete building blocks may be used for buildings six stories or less in height where said use is approved by the Chief Engineer; provided, however, that such blocks shall be composed of at least one (1) part of Standard Portland Cement, and not to exceed five (5) parts of clean, coarse, sharp sand or gravel, or a mixture of at least one part of Portland Cement to five (5) parts of crushed rock or other suitable aggregate.

2. All material to be of such fineness as to pass a one-half inch ring and be free from dirt or foreign matter. The material composing such blocks shall be properly mixed and manipulated, and the hollow space in said blocks shall not exceed the percentage given in the following table for different height walls, and in no case shall the walls or webs of the block be less in thickness than one-fourth of the height. The figures given in the table represent the percentage of such hollow space for different height walls.

Stories.	1st.	2d.	3d.	4th.	5th.	6th.
1 and 2,	33	33				
3 and 4,	25	33	33	33		
5 and 6,	20	25	25	33	33	33

3. The thickness of walls for any building where hollow concrete blocks are used shall not be less than is required by law for brick walls.

4. Where the face only is of hollow concrete building block, and the backing is of brick, the facing of hollow concrete blocks must be strongly bonded to the brick, either with headers projecting four (4) inches into the brick work, every fourth course being a heading course, or with approved ties; no brick backing to be less than eight (8) inches. Where the walls are made entirely of hollow concrete blocks, but where said blocks have not the same width as the wall, every fifth course shall extend through the wall, forming a secure bond. All walls, where blocks are used, shall be laid up in Portland Cement Mortar.

5. All hollow concrete building blocks, before being used in the construction of any building, shall have attained the age of at least three (3) weeks.

6. Wherever girders or joists rest upon walls so that there is a concentrated load on the block of over two (2) tons, the blocks supporting the girder or joists must be made solid. Where such concentrated load shall exceed five (5) tons, the blocks for two (2) courses below, and for a distance extending at least eighteen inches each side of said girder, shall be made solid. Where the load on the wall from the girder exceeds five (5) tons, the blocks for three courses beneath it shall be made solid with similar material as in the blocks. Wherever walls are decreased in thickness, the top course of the thicker wall to be solid.

7. Provided always that no wall, or any part thereof, composed of hollow concrete blocks, shall be loaded to an excess of eight (8) tons per superficial foot of the area of such blocks, including the weight of the wall, and no blocks shall be used that have an average crushing at less than 1000 pounds per square inch of area at the age of twenty-eight (28) days; no deduction to be made in figuring the area for the hollow spaces.

8. All piers and buttresses that support loads in excess of five (5) tons shall be built of solid concrete blocks for such distance below as may be required by the Chief Engineer. Concrete lintels and sills shall be reinforced by iron or steel rods in a manner satisfactory to the Chief Engineer, and any lintels spanning over four feet six inches in the clear shall rest on solid concrete blocks.

9. Provided, that no hollow concrete building block shall be used in the construction of any building unless the maker of said blocks has placed on file with the Chief Engineer a certificate from a reliable testing laboratory showing that samples from the lot of blocks to be used have successfully passed all the requirements.

10. A brand or mark of identification must be impressed in, or otherwise permanently attached to, each block for purpose of identification.

11. Portland Cement shall be used in the manufacture of concrete building blocks and must meet the minimum requirements set forth in the standard specifications for cement, adopted by the American Society for Testing Materials.

12. At any time the Chief Engineer may elect, samples of the concrete blocks used in building construction may be subjected to and must meet the following tests: The ultimate compression strength in pounds per square inch at the end of twenty-eight (28) days shall not be less than 800 pounds per square inch. The absorption shall not exceed fifteen (15) per cent. The modulus of rupture on a seven (7) inch span shall not be less than 150. Two samples shall be placed in a cold furnace in which the temperature is gradually raised for normal conditions to 1700 deg. F. The test piece must be subjected to this temperature for at least thirty minutes. One of the samples is then plunged into cold water (60 or 70 deg.), and the second sample permitted to cool gradually in air. In neither case shall the concrete disintegrate.

EXPANDED METAL AND CEMENT CONSTRUCTION FOR WALLS.

The plastered walls shall be constructed as follows:

To the girts of the building shall be fastened 6" furring strips of $\frac{1}{2}$ " plain bars placed horizontally every 18" and held in place with two $2\frac{1}{2}$ " staples of No. 10 wire. One-half inch round plain vertical bars, spaced every 18", shall be securely fastened against the furring strips and to the girts by two $2\frac{1}{2}$ " staples of No. 10 wire. Diamond mesh expanded metal or spiral lath expanded metal of No. 24 gauge of sheets 24" wide by 96" long shall be securely wired to the $\frac{1}{2}$ " vertical rods, and shall cover the entire wall area.

All joints shall be lapped at least 1" and securely laced with wire.

At the corners of all windows in the walls and at the two upper corners of the doors a piece of expanded metal shall be placed diagonally across to reinforce them.

At the two outside corners of the end walls a vertical strip of metal lath 24" in width shall be applied over the specified reinforcement and bent around the corners to prevent cracking at these points.

All metal used in this construction shall be plain black iron or steel and shall not be painted or galvanized.

On the outer metal lath put a scratch coat consisting of a mixture of one sack of cement of not less than 90 lbs. net to 3 cu. ft. of lime mortar. Then build out by plastering on both sides until the finished wall is $1\frac{1}{2}$ " thick, using a mortar consisting of one sack of cement of not less than 90 lbs. net and $2\frac{1}{2}$ cu. ft. of good clean sand. This coat to follow first coat not later than 24 hours. The inner metal lath shall be plastered on one side only, but similarly to the above to a thickness of one inch. The lime mortar referred to above to be made in the proportion of one barrel of well slacked first quality lime, 15 barrels sand, and 2 lbs. of cocoanut fiber, the entire mass to be well mixed and allowed to stand two weeks before being used.

After the walls have dried, the outside surface shall be coated with two coats of water proofing compound.

All surfaces of wooden windows or other frames should be covered with tarred paper where cement comes in contact, to prevent the absorption of the moisture from the cement, and to secure a good joint.

The work shall be done in the best manner known to the plastering trade; the metal lath and rods shall be entirely covered, and the walls left with a good smooth finish.

A. O. CUNNINGHAM, *Chairman.*

T. J. FULLEM,

M. RINEY,

Committee.

(No discussion.)

III.

EXPERIENCE AS TO EXPANSION AND CONTRACTION OF CONCRETE WALLS, EITHER REINFORCED OR PLAIN CONCRETE.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

The committee on subject number three, "Experience as to Expansion and Contraction of Concrete Walls, Either Reinforced or Plain Concrete," submits the following report:

After thoroughly investigating the above subject of expansion and contraction of concrete, your Committee finds that with varying temperature some provisions must be made for wall movement, similar to the expansion of steel, though the latter requires more than the former. After innumerable investigations as to method employed to provide expansion, the Committee finds there is no specified rule to govern movements of concrete under these various conditions and temperatures, either natural or artificial, as local conditions and atmospheric changes and natures of structures require.

In walls that are exposed to natural atmospheric changes in temperatures on all sides, provisions must be made for wall movement, more than if only surface is exposed, the other portions being protected by embankment, etc. Retaining walls 200 feet long and over, 10 to 20 feet high, should have an expansion joint every 45 to 50 feet, as conditions require them. Concrete curbs 4 to 5 feet wide, 6 inches to 12 inches thick, should have an expansion joint every 5 feet square.

Reinforcing used in concrete will, to a certain extent, prevent concrete from separating, but will not prevent slight cracks from appearing on the surface. These cracks do not confine themselves to any particular direction, though usually running vertically and horizontally, the former appearing from 3 to 4 feet apart in curbs 350 feet long, 8 inches high, reinforced with five half-inch Johnson corrugated bars distributed throughout the curb. The horizontal cracks are not so frequent and irregular. Corrugated bars being partly protected by the concrete from atmospheric changes, make the expansion between the bars and concrete unequal, to which the cracking above referred to is attributed, the two expanding about equally under same temperature and exposure. These cracks are not due to shrinking, which only appears at initial setting of concrete, but to expansion and contraction, they appearing thirty to ninety days after job is completed and after passing through a shrinking period.

Joints in wall and curbs should be made dovetail, so as to maintain a true alignment of the wall on the exposed surface. Various methods are employed in making the joint, one of which

is to use a sufficient number of layers of felt paper to obtain the desired thickness and cushion. Another practice, in large retaining walls, is to build each alternate section dovetailed together, allowing each alternate section to be thoroughly seasoned before succeeding section is built, and allowing disconnected joint to provide expansion in this manner, which appears to be most satisfactory.

Expansion in sidewalks, or similar work, is overcome by cutting through the concrete before finished surface is applied, leaving a space sufficiently filled with dry sand, or open, as desired.

Where artificial or natural temperatures are maintained uniformly at all times, expansion joints can be dispensed with, as in subways, dams, smokestacks, buildings, and constructions of similar nature. Tunnels 750 feet long, with lateral tunnel diverging at right angles from center of main tunnel for 350 feet, through which steam, water and air pipes are hung, have been built and in service for the past three years, and no indication of cracks can be seen. In this case, the temperature varied from 110 to 175 degrees inside of tunnel. The tunnel constructions are of concrete $4\frac{1}{2}$ feet wide throughout, $5\frac{1}{2}$ feet deep from surface of ground at one end and 3 feet at terminal, the side walls and bottom 12 inches thick throughout, and the cover 4 inches, the cover being bonded to sides of tunnel, reinforced with No. 8 expanded metal one inch from lower side and troweled on the surface. The cover is used as a sidewalk and a truck-way for trucking material from different buildings, it being at the surface of the ground. In putting on the cover, light expansion joints were made by cutting through concrete every 5 feet at joint of each sheet of expanded metal before putting on top dressing, filling joint with dry sand to one inch below surface. No expansion has taken place whatever in any of these walls, including cover, no provision having been made in side walls or bottom for expansion. Had any taken place, it would have been noticed by cracks appearing on the surface, close observation having been made at intervals of different temperatures of the weather and under all conditions. Even temperatures were maintained by heat from pipe in the tunnel to supply steam, etc., to buildings.

In conclusion, there is no set rule that can be given to guide the expansion and contraction, local conditions and sub-grade entering into the amount of expansion to be provided for. Floors and sidewalks built on cinders or material that attracts heat require more expansion provisions than those built on soil, which does not attract heat so readily. This same rule would also apply to floors protected from the sun in basements, or similarly located.

A. S. MARKLEY,
R. H. REID,
W. A. RODGERS,
P. J. O'NEIL,
Committee.

DISCUSSION.

Mr. Schall.—There must be some of the members who have had experience with long concrete walls cracking by reason of expansion, not having provided expansion joints. While I have had very little experience myself, I should like to hear from those members who have had extended experience in this kind of work. I should like to have an expression from Mr. A. S. Markley.

Mr. A. S. Markley.—I have said my piece in my report.

Mr. O'Neil would say for the benefit of the members, that I don't think a long continuous line of concrete can be built and exposed to the weather in our climate without its breaking itself up into sections of different lengths. I built this year four concrete walls, each one six hundred and fifty feet long, and they are about sixteen feet high. We got two of the walls completed and without a crack, and they were reinforced with steel heavily. But we had a cold night, when the temperature dropped to about forty, and both walls cracked in two or three places. It didn't amount to much, but simply showed a break line; don't think it has weakened the wall any. The other two walls have not shown any crack. They were built through the warm weather.

Mr. A. S. Markley.—The report deals with reinforced concrete, and the reinforcing of concrete will not prevent the concrete from cracking, once you are obliged to provide for its expansion and contraction. We tried it in a platform curbing and various cracks would appear in the concrete. They were irregular in distance. Sometimes they would run diagonally, sometimes vertically, sometimes horizontally. No special plan can be provided which will avail for all parts of the country. Where we have even temperature the year round there is no necessity of providing for expansion and contraction; but of course, in this country, in Wisconsin, it would be absolutely necessary to do so on account of atmospheric changes.

Mr. Hadwen.—The question of the expansion of concrete seems to me largely one depending upon the structure and the amount of concrete that is being used, whether heavy masses or long, thin walls. It is the practice on our road, wherever we build long culverts, etc., and large abutments, to provide expansion joints about every fifty feet. I noticed not long ago in one of the technical journals (*Engineering News* of May 9th, 1907) that the government engineers had been making experiments on some breakwater work of various kinds, and one of them came to the conclusion that he could hold moderately heavy masses of concrete in the walls without any trouble by reinforcing sufficiently to provide for expansion. As I say, our practice has always been to use an expansion joint about every fifty feet.

Mr. Aldrich.—A great many of you will probably remember where we went to see the concrete pile driven in Boston last year, and I will just state that we have several freight houses five hundred feet long built on the same kind of foundations. They have a concrete foundation that comes up about four feet above the top of the ground. The one that we did not reinforce is badly cracked and the others, that were reinforced with old rails, have not a crack in any of them. I do not know how many rails were put in, but I do know they put in rails, and I do know that they have not cracked.

Mr. Schall. I should like to hear from members who have had experience in reinforced concrete and to ask whether they use plain round bars or the patent twisted, or other special bars.

Mr. A. S. Markley.—We use the Johnston bar for reinforcing.

Mr. Hughes.—We use corrugated bars altogether.

Mr. Killam.—On the Intercolonial Railway we have some large machine and car shops. They are all built of concrete; that is, the walls, foundations and the roof is concrete and every part of the concrete is all reinforced with ex-

panded twisted metal. I have not examined them lately very closely, but I am told there are no cracks in them. Some of these buildings are five hundred feet long and of different sizes and they are all reported as having no cracks, and all in good condition. Now in regard to platforms, a great many of our platforms have cracked, as Mr. Markley says, diagonally. However, they are only small cracks and nothing that would do any particular harm. We did put down lately a sidewalk one thousand feet long and seven feet wide, and that was put in by excavating and putting down seven inches of cinders and then the concrete was laid on that six inches thick and then an asphalt preparation on top of that, then finished with a coat of cement, and I have looked at that lately and there is not a sign of a crack in any of it, from end to end. No contraction or expansion, and the buildings, as I said before, are reported to be complete and intact from cracks, every part of them. These were constructed with this expanded metal, the roof and all, and there are no cracks in the roof.

Mr. O'Neil.—I think the strain on a concrete wall differs very little from a platform. The greatest strain that we get on platforms is caused by unequal freezing of the ground underneath and I doubt if you can put a platform down that will not crack, unless you bar out the frost. And in regard to the matter of reinforcement, we use corrugated bars and twisted bars of various sizes. And we also use scrap rail in heavy work, and I have used a few tons of old scrap pipe and find it is just about as good as anything.

Mr. Killam. We have been building some four or five new engine houses, twenty to forty stalls. The foundation is of concrete, the pits on the inside are all concrete, also the drops for taking of the wheels out from under the locomotives are concrete; and the walls of these engine houses are about four feet below the surface and built three feet above the ground and then brick from there up, and in

none of them have any cracks appeared. No provision was made for cracking and no cracks have appeared in them, but they are all reinforced with expanded metal.

Mr. Carr.—What proportion or mixture did you use in the concrete?

Mr. Killam.—One to three of sand and cement and four of crushed stone.

Mr. Schall.—I should like to be informed whether any member present used the plain round bars for reinforcing concrete.

Mr. A. S. Markley.—Some of the Pennsylvania railroad people use something of that kind, I think.

Mr. Large.—We have built some arches on our line and the fact is we didn't use any reinforcement at all, excepting just the wire that we held our forms together with. That is all we have used. The first one was built about seven years ago, a 35-foot arch and about 65 feet long. We were all new to the business, but we didn't put in any reinforcement at all, only a few wires that we held the forms together with, to keep them from spreading.

Mr. Storck.—The city is building now one of the largest arches in the world across a street in Philadelphia. I don't know just how they are constructing it, but I can find out. In Philadelphia concrete is used very much in buildings and in bridges and the city builds all their platforms out of concrete. This concrete is in its infancy and I think this subject should be continued, as we will know more about it in a year from now than we do at the present time.

Mr. Clark.—In answer to Mr. Schall's question as to using plain bars, we use some plain bars and also some old rails, as some of the other members have spoken of, or whatever is available. I think a year ago I made a remark about putting in a couple of abutments for a five-track bridge. On one side we put in expansion joints, on the other side we did not. In order to see if there would be any difference, I looked at those walls about ten days ago

and I can see no difference whatever. The expansion joints have never opened and the other side, where we had none in, has never cracked. Of course, that is all heavy concrete work. With our concrete platforms, we cut them into five-foot sections; the same way with the curbing, and they give no trouble.

President.—If nothing more on this subject, we will pass to the next one, as our time is getting short and these subjects will come up again next year.

IV.

ACTION OF SEA WATER ON CONCRETE.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your Committee on Subject No. 4, "Action of Sea Water on Concrete," beg to report as follows:

We sent out about forty circulars to as many different members of the Association as follows:

Your Committee on Subject No. 4, "Action of Sea Water on Concrete," desires your cooperation in the preparation of a report which should be of interest to all concerned.

1. Concrete made in air and sunk into sea water.
2. Concrete deposited direct into sea water.
3. What effect has the rise and fall of tide water on concrete?
4. What effect has the frost on concrete where the tide rises and falls on concrete?

Out of the forty circulars sent out we have received ten replies, five of which say no experience; the other five are very valuable and have given your Committee all that they have had to work on.

One of our New York friends writes as follows:

1. Where there is no ice formation, concrete, if made in air with fresh water and then sunk into sea water works well, but shows a tendency to disintegrate slightly on the faces between low and high water levels.

2. I would not deposit concrete direct into sea water. Where the salt water permeates the whole mass of concrete the faces disintegrate faster than where the concrete mixed with fresh water is made in air and then sunk into position in the sea water.

3. Between low and high water the faces of the concrete show a tendency to disintegrate.

4. Where there is severe cold and a large ice formation concrete exposed to the rise and fall of the tide will disintegrate on the exposed faces. (In my experience to a depth of $\frac{1}{8}$ inch to $\frac{3}{4}$ inch.) If this disintegrated portion is faced up with cement mortar each spring there will be no further trouble until the ice goes out the next winter. In my judgment bridge piers and abutments should be built from about 2 or 3 feet below extreme low water to the top of the masonry, of granite ashlar dressed

smooth on the faces exposed to the ice and salt water and backed with concrete.

Another of our New York friends writes as follows:

1. Mix it dry and put it through chutes into the water; never mix with water before putting into bed.

2. Concrete deposited into sea water will be covered under "1." Would say that in the vicinity of New York there is very little of this done; most of the concrete handled at this point is made into blocks and sunk to the depth required and handled by divers. This seems to be the better method and gives more satisfaction than trying to put it in in any loose form.

3. The rise and fall of the tide seems to have no effect whatever on the concrete blocks when placed as I have mentioned above. The frost does not seem to have any appreciable effect on the concrete. Enclosed you will find a booklet of small blue-prints showing the method of handling concrete in the vicinity of New York. Very often the granite blocks are placed above the sub-structure of granite blocks, as granite is known to be much stronger than concrete. In places where foundations are on a slope concrete filled in bags are sunk, which makes a very solid foundation.

The replies from the vicinity of Boston favor the concrete deposited direct into sea water.

The following from one of our Boston friends:

2. Concrete deposited direct into sea water. So far as I know this gives perfectly satisfactory results if the material and method of work are right. The cement should contain not over 2 per cent sulphuric tri-oxide and a low content of magnesia; the sand should be good and crushed stone should be used rather than pebbles; the mixture should be not leaner than one, two and four, and it should be deposited either with a tube or a bucket on the O'Rourke pattern, which opens wholly inside the bucket, making practically a closed tube for the concrete to drop through. In using a tube the first charge is bound to be washed, hence it is best to begin operations each morning out in the area well away from the forms, so as not to have washed concrete on the outside of the mass when finished. This is difficult to impress on the workmen, as they always want to start operations at one corner. At times there is trouble from the milk of lime, or "laitance," as the French call it, which is too heavy to float away in the water. If it collects more than about three inches thick, it should be pumped off or otherwise disposed of; it will not harden, and if covered into the mass will make a weak section. If concrete is properly deposited in pure sea water it sets even stronger than in air, but I prefer to have a stone masonry facing between high and low water. If concrete is exposed to the sun's action between tides it must be extraordinary good to withstand the combined action of all the forces acting to disintegrate it. An example given as successfully deposited under water, is shown on pages 60 and 61, Proceedings of our Association for 1901.

There are a large number of piers around Boston built similarly to this, and there has been no failure or trouble with them due to lack of integrity of the concrete. It will be noted that above low water the pier is faced with stone. Attention is always given to the chemical constitution of the cement used, and it is tested for soundness in sea water by the so-called barrel test. This consists of placing a small barrel in a large cask filled with sea water, and then filling the small barrel with cement through a small tube. After 24 hours the cask is dumped and the barrel cut off from the concrete. If the cement is suitable to use, the concrete will be quite hard and will require a pick to break it up. Analysis for sulphuric acid should accompany this test, as the barrel test alone will not prove durability. A remarkable instance of concrete made in air and sunk into sea water, *vide* item 1, has just been executed at Brunswick, Ga., where reinforced concrete piles 18 inches square, 41 feet long, tongued and grooved, have been placed for a pier facing. These are rodded back to a double row of timber piles and the pier is filled solid with earth. Timber fender piles are driven in front of the concrete face to take the blows from vessels. The concrete piles are sunk by water jet through a pipe cast in the center of the pile.

3. All of the replies seem to agree that concrete should be faced with granite above low water, as the rise and fall of the tide has a tendency to disintegrate the concrete.

4. All of the replies seem to agree that frost and ice formation, where tide rises and falls, has a greater tendency to disintegrate the concrete.

Your chairman has made it a particular object to examine quite a number of structures of concrete in tide water in the vicinity of Boston, and has found in every structure examined disintegration was taking place with more or less rapidity between high and low water, in some cases, notably the arches under the piers at Charlestown Navy Yard, this disintegration being to such an extent as to seriously affect the stability of the work. Your chairman has been informed by those who are constantly on the work at these different places that this disintegration was considerable more rapid in cold weather when frost was experienced than at other times, although disintegration occurs even in warm weather. In some cases the concrete scales off in quite large patches, but in most of these cases it comes out in small particles, so that the stones which form a part of the concrete were left projecting out from 1 inch to 2 inches beyond the general surface, or until such time as the weight of the stone would offset what little holding power remained to the concrete at the inner point of the stone.

Your chairman finds the same trouble with granite above low water. He has examined several places where the mortar has disappeared in the joints and had to be repointed after 3 or 4 years.

Your chairman has also looked over a concrete pier on the Providence River, at Warren, R. I., which was built about 25

years ago with a mixture of sand and cement of about 1 to 3. This concrete is in a good state of preservation, except between high and low water, where it is worn away in places from 4 to 8 inches, which looks as if it was done more by the current and ice as the tide ebbs and flows, rather than by the combined action of frost and tide water rising and falling. The current at this point runs at about the rate of 8 miles per hour, which is pretty fast, and causes quite a whirlpool as it passes the pier.

As before mentioned, your Chairman noticed near the same place granite abutments where the pointing was all gone between high and low water; above high water the pointing was in good condition.

It is the opinion of your Committee that item "2" is the cheapest and best method of sinking concrete into sea water, and if properly mixed with proper material and properly handled and faced with granite above low water, that with a suitable number of headers to make granite masonry firm, it will do good service. Your Committee also thinks that it would add to the stability of the granite if the joints were calked with lead.

Very truly yours,

G. ALDRICH, *Chairman*,
WILLARD A. PETTIS,
GEO. W. ANDREWS,
JOHN E. BARRETT,

Committee.

SUPPLEMENT TO SUBJECT NUMBER FOUR, "ACTION OF SEA WATER ON CONCRETE.

Since writing report on the above subject, your committee has received some photographs showing some of the disintegrated concrete mentioned in the original report, namely the Cambridge bridge, City of Boston, and the sea wall at Charlestown navy yard. Your committee thinks it would be well to have this entered as a supplement to the original report.

G. ALDRICH,
Chairman.

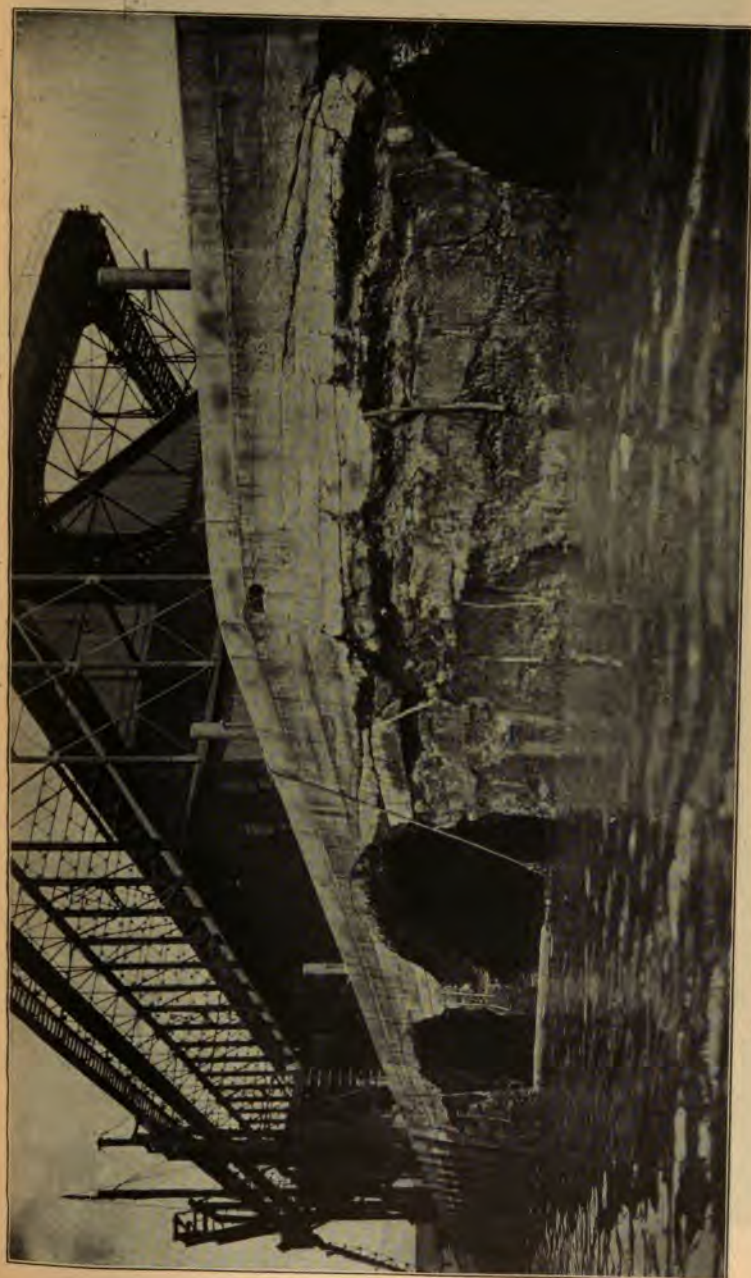


FIG. 20.—Charlestown Navy Yard, Concrete Masonry West Side of Pier No. 1.



FIG. 21.—Charlestown, Mass., Navy Yard Concrete Masonry, July 1st, 1907.



FIG. 22.—Charlestown, Mass., Navy Yard, Concrete Masonry on East Side of Pier No. 1, July 1st, 1907.



FIG. 23.—Cambridge, Mass., Bridge, April, 1902.



FIG. 24.—Cambridge, Mass., Bridge, 1907.

DISCUSSION.

Mr. Aldrich.—I will say that since making this report I have received some photographs. I have also a paper giving some data about the Charlestown bridge, which may be interesting to our members. The photographs are here and you can all see them. I believe there is a considerable amount of information in this paper, which was sent me, and provided the secretary cares to put it in his proceedings, I will have it typewritten and send a copy of it to him. I will read from a supplement that I have prepared to my report. (See supplementary report, which was read by Mr. Aldrich.)

Mr. Aldrich.—I think also it may be well to have these photographs shown in our proceedings.

Mr. A. S. Markley.—This is a new condition of deterioration. I remember the remarks we heard about this bridge at our last meeting in Boston, but it was too late to visit the place. Is it the salt water that causes this deterioration, or is it the tide that ebbs and flows every twenty-four hours? I have heard of using salt to keep the cement from freezing. Why is this not a bad thing for the concrete if it is true that the salt water causes this deterioration referred to? If the proper solution is embodied in the report of using granite stone on the outside and concrete for backing, in that case I should think it would be a hard matter to make mortar joints or to point up the masonry, unless a cofferdam is built to keep the water out until the cement sets.

Mr. Killam.—This is a question that I have paid considerable attention to along the Intercolonial Railway. We have a great many structures in salt water and the masonry which was first put up was poor and did not stand the effect of the water and began to dissolve, and we put concrete around it, but it only stood a year or two until that began to dissolve; so there is no question from our experience but that the salt does disintegrate the concrete.

Mr. Parker—I would like information as to what kind of cement was used in that work.

Mr. Killam—We use Portland cement, White Brothers brand, or other cement of equal quality, but sometimes when not watched, contractors will get a poor quality in; but we endeavor to use the very best cement that can be obtained, and the question of price has nothing to do with the work. It is the best article that is wanted.

Mr. Parker—We have never found but one kind of cement that will stand the action of salt water, that is, the Gellingham brand of Portland. We have tried German cement and several other brands, but have found nothing to equal the Gellingham brand.

PRELIMINARY OBSERVATIONS ON THE SUBJECT OF THE DECOMPOSITION OF CEMENTS IN THE SEA.

By N. Henry Le Chatelier, Chief Engineer of Mines.

I have decided to make before the Congress of the International Association of Methods of Testing, which meets this year at St. Petersburg, a report on the actual state of studies relating to the decomposition of cements in the sea; but in trying to get together the necessary documents I have not been able to find anything of a similar report, or at least it would come to about this:

The work done in the last five years has verified the three following statements of Vicat:

1. All the hydraulic lines when put in intimate contact with sea water are totally decomposed by the chemical action of the magnesium salts in the course of a more or less long time.
2. Mortars decompose the more slowly as they are more compact.
3. They are decomposed the more slowly as the hydraulic index is raised, counting in that index the silica and alumina combined to the lime, either during the roasting or in the case of the addition of pozzuolona, during the setting.

I will content myself with presenting a personal memoir having for its definite object the method to be followed in the future in order to arrive at better results than in the past. The check of innumerable experiments made on the decomposition of cements in the sea proves the exclusively empirical method followed heretofore. The so fruitful scientific method of Vicat was abandoned immediately after his death, producing a fatal reaction against his ideas.

The general tendency, as much among the cement manufacturers as among the engineers, is to make these studies by trying in the sea under the conditions ordinarily employed, blocks of masonry of the usual variety and in following the progressive steps to their destruction. To draw any practical conclusions from such trials one must wait at least half a century.

France is the only country in which this question has been taken up in order from a reasonably early time. In 1853 the ministers of public and marine works gave the order to organize on a definite plan studies of that nature in the principal French ports. Unfortunately, they had not the perseverance to keep them up and today the port of La Rochelle is the only one which possesses a complete series of results. All of the blocks used in the experiments at that port have today disappeared. The most resisting ones had been made, one with a very rich mortar of an English Portland cement, finely ground, the second with mortar of a maritime cement of high index, made by Vicat.

In Germany they organized some years ago experiments of the same nature, but it will be necessary to wait a long time before drawing any conclusions. In France they are too busy to take up these studies again. The experiments of the past perhaps authorize a certain skepticism in regard to the results of the future.

It will not be useless to recall at the beginning of this work the essential differences between the methods of empirical and scientific research.

Every natural phenomenon is a function of a certain number of simple factors of independent variables:

$$z=f(x, y, z.)$$

The scientific method consists in seeking systematically:

1. What all the independent variables are, on which the considered phenomenon depends.

2. What is the relative importance of each of these variables on the size of the phenomenon studied?

3. And as far as possible, what is the algebraic form of the function which connects the phenomenon and its factors? In order to arrive at this determination the method followed consists in making vary at one time one of the variables of the function and to follow the law of this variation.

The empirical method on the contrary makes very simultaneously and by chance all the conditions of the phenomenon, contenting itself with measuring the size of the most obvious ones; then in comparing the measures thus made with the results obtained, one seeks, if an evident relation presents itself, between the phenomenon studied and the conditions causing it.

When the question is of a simple phenomenon, such as the relation between the weight of a mass of water and its volume, the proportionality between the weight and the volume is obvious. If in the place of one independent variable there are two, as in the law of Mariotte and of Gay-Lussac, one may yet with certain measures made by guess at length recognize how the pressure of the gas varies as a function of its volume and of its temperature; but as the number of these variables becomes infinitely great and as the number of combinations of the different sizes of these variables increases in consequence of following a still more rapid law, it is obvious that it becomes impossible to distinguish anything with precision by means of experiments made without method.

In order to make clear this question of the decomposition of cements in the sea, it is necessary to decide to follow a step perhaps slow in appearance but much more certain,

consisting of studying point by point all of the elementary conditions on which it depends. It is this method that I wish to try to apply in this paper.

ELEMENTARY FACTORS IN THE DECOMPOSITION OF CEMENTS IN THE SEA.

In the decompositions of cements by the sea we have in the first place to consider four different kinds of matter, cement, sea water, with all the substances which it holds in solution, living beings with the shells and vegetables which fix themselves to the surface of the cement, and last the atmosphere which acts by its carbonic acid gas or by its water vapor.

The different substances transform themselves, that is, they are the seat of phenomena of various kinds, chemical, physical and mechanical. The various numerous chemical phenomena include the setting of the hydraulic limes, the decomposition of the compounds so formed by the sea water and at length the combination of these products with the elements either of the cements or of the sea water. The physical phenomena depend on the more or less great porosity of the mortars and on the properties of diffusion of the salts contained in the sea water, and finally in masonry alternately exposed by tides to the action of the air and of the water, they produce by evaporation concentration of salts at certain points in the masonry. The mechanical phenomena include the movement of blocks of masonry by waves, their rupture by the shock of these waves, or their wear by the friction of sand.

But this is not all. None of these elementary phenomena can be produced without exercising an effect on the other phenomena; the cracks and the wearing produced by the mechanical action of the sea water facilitate the physical diffusion of the salts and this in its turn favors the chemical action of these same salts by bringing them into contact with the lime. On the other hand, the chemical actions which develop in the masonry cause cracks facilitating the penetra-

tion of the salts and the rupture of the blocks of mortar under the action of the shocks of the sea, etc.

In this study we will notice only the chemical phenomena, by far, however, the most important, and we will consider the part of the physical and mechanical phenomena only to the extent to which they can influence the chemical phenomena studied.

FIRST PART.

Elementary Chemical Phenomena.

To proceed from the simple to the complex, we must study the actual chemical nature of different bodies together, then the reactions of which they are individually the seat, and at last the double mutual decompositions which they produce among themselves.

Sea Water.—The chemical composition of sea water is practically constant when one takes it at large and far from shore. In harbors, on the contrary,—that is to say, where the decomposition is especially interesting to study,—the composition of the sea water is quite variable. It is very often diluted by the presence of streams which tend by diminishing the saline concentration to diminish its action; but on the other hand it contains sometimes the organic products coming from the sewage of towns, whose presence cannot be without effect. This is stated sometimes without having, however, any definite facts to advance.

Here is the chemical composition of sea water from the Mediterranean compared with that of artificial sea water, whose preparation is indicated further on:

		Artificial.		Mediterranean.
Sodium	Na	11.6	gr.	11.5 gr.
Magnesium	Mg	1.27	gr.	1.3 gr.
Calcium	Ca	0.35	gr.	0.4 gr.
Potassium	K	0.08	gr.	0.5 gr.
Chlorine	Cl	20.2	gr.	20.4 gr.
Sulphuric Acid	SO ₄	2.76	gr.	8.9 gr.
Free Carbonic Acid		0.044	gr.	0.0497 gr.

Here are the total quantities of salts contained in sea water taken from different places and reduced to one liter:

	Grammes.
Vincent.—Voyage of the Isis in the Atlantic and Pacific Oceans, from	85 to 89.0
Forchamer.—North Sea	83.0
Atlantic	84.3
Mediterranean	87.5
Usiglie.—Mediterranean	87.7
Thorpe.—Irish Sea	85.85
Pittmar.—Voyage of the Challenger in the Indian and Atlantic Oceans, from	83.0 to 87.0
Candlot.—English Channel	85.7

For laboratory experiments when one has not at his disposal sea water of a well-determined composition one must often use an artificial sea water made up of all its parts. Here is the formula which has been recommended in my proposition for the French Commission of Methods of Testing.

		Grammes.
Chloride of Sodium	NaCl	30.0
Crystallized Magnesium Sulphate	$N_2O_5SO_4 \cdot 7HO$	5.0
Crystallized Magnesium Chloride	$M_2Cl_2 \cdot 6HO$	6.0
Hydrated Calcium Sulphate	$CaO \cdot SO_3 \cdot 2HO$	1.5
Potassium Bicarbonate	$KO \cdot HO \cdot 2Cl$	0.2
Distilled water		1000.0

It is important not to suppress, as one is sometimes tempted to do, certain substances found in small quantities in sea water, such as calcium sulphate and the bicarbonates. The small quantities of these substances have a very great influence upon the degree of preservation of the mortar. The first of these substances causes considerable activity of decomposition, while the second retards it in a very marked degree.

When the water is put in contact with lime or calcareous salts like those of cement, the whole of the magnesia is precipitated and it forms the corresponding salts of calcium remaining in solution. The composition of the liquid ob-

tained, starting for example with the water of the Mediterranean, is given in the following table:

Sodium Chloride.....	30	grammes per liter.
Calcium Sulphate (CaSO_4).....	4.1	grammes per liter.
Calcium Chloride (CaCl_2).....	3.0	grammes per liter.
Potassium Chloride.....	1.0	grammes per liter.

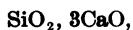
The proportion of calcium sulphate indicated is greater than that which corresponds to normal saturation in soft water. Its solubility is somewhat increased in the presence of sodium chloride and the excess remains at least momentarily in the state of super-saturation.

CHEMICAL COMPOSITION OF THE HYDRAULIC PRODUCTS.

The exact nature of the chemical combinations which pre-exist in the cement, or which form during their hydration, is evidently an important element in the problem studied. We will sum up the results generally admitted on this subject.

The different hydraulic limes are obtained by roasting intimate natural or artificial mixtures of limestone and of so-called argillaceous substances, including silica, alumina and iron. Under the action of the heat the limestone becomes decarbonated, then enters into combination in a manner more or less complete with the argillaceous matter. In order that these combinations may reach their limits it is necessary that the temperature of roasting be sufficiently high, say between $1,400^\circ$ and $1,700^\circ$, according to the nature of the mixtures, that this temperature be maintained during a sufficient time, which ought not to be less than one hour, and at length that the resulting substance be sufficiently fine to produce a homogeneous mass.

The chemical combinations taking place under the action of the heat are very varied. That which plays the most important part in the setting of hydraulic limes is the tricalcite of silica



whose existence, discovered by M. Le Chatelier, has been

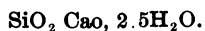
confirmed since by Newberry. This substance is found in Portland cements, hydraulic limes, and also, although in less quantity, in cements quickly roasted at a low temperature.

The aluminum and the iron give with the lime under the action of heat mono, bi and tri calcites of aluminum or iron. These three series of compounds dissolve when put in contact with water. We do not know exactly which of these has its beginning in the cement; we ought consequently to find there either one or the other.

The silica, aluminum, iron and the lime also give silico-alumino ferrites of calcium, which combined remain inert during the hydration. At last there often exists uncombined lime, a small proportion in cements, a somewhat larger proportion in the hydraulic limes. Such are the constituents of all the hydraulic products obtained directly by roasting.

A second kind of hydraulic products, called pozzuolanic products, are made by mixtures of slaked lime with silicious materials, which have the property of combining in the presence of water with the lime. These silicious materials are natural products generally of volcanic origin, and externally altered by water, such as trass, or pozzuolona. Others are of artificial products, such as clay, torrified at a low temperature. At length, in certain cements, roasted at low temperature, it appears that the argillaceous matter incompletely combined with the lime has preserved pozzuolanic properties.

Under the action of water these different silicates and aluminates produce compound hydrates. The hydrated silicate of lime has for its formula:



It is produced, either by the direct combination of the silica of the pozzuolanic materials with the slaked lime, or by the breaking down of the tricalcite of silica in the presence of water, which gives, in connection with the hydrated silicate, a crystallized hydrated calcium in great hexagonal

lamellas. Actually, the analysis of the hydrated silicate of lime is not exactly that of the monocalcite of silica. It includes, as was shown by M. Le Chatelier and since confirmed by M. Newberry, 1.7 to 1.8 parts of lime to 1 of silica. The excess of lime is held by a sort of capillary attraction of the monocalcite of silica, the crystals of which are extremely tenuous, in the same way as it fastens itself on very porous bodies, such as wood charcoal. We give, therefore, to this compound the formula of dicalcite of silica, which is actually nearer to the composition found directly by experiment; but it is a free hypothesis formally contradicted by this, that if one washes the silicate of lime with distilled water, one removes progressively its excess of lime without reaching the concentration of the liquid constant in lime, so much that the composition of the silicate does not mix with that of the monocalcite of silica.

President.—If nothing more on this subject, we will pass it. This closes all the discussions of subjects or reports for this year, and we will now proceed with unfinished business.

V.

RECENT EXPERIENCE IN THE USE OF WOODEN
AND ASBESTOS SMOKE JACKS.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

The committee selected on the above named subject beg leave to include in their report various other kinds of jacks in common use, making the subject as comprehensive as possible.

Attention is called to Subject No. 4, "Report of Committee on Round House Smoke Jacks and Ventilation," page 112 of the Eighth Annual Proceedings of the Convention, held at Richmond, Va., in October, 1898, wherein the committee makes the following statement:

"It is evident to your committee that there is great diversity of opinion as to the best style of jack to be used, the opinions in many cases running counter to each other. The committee will not undertake to unravel the mystery, but submit a number of sketches of the various styles of jacks and other ventilators, with an appendix giving the views of a number of gentlemen who were kind enough to favor your committee with notes from their experience."

The undersigned committee is fully as unable, after nine years have elapsed, to say which is the best form and best material for engine house jacks. It is safe to say, however, that some of the compositions of asbestos that were new at that time have proved to be failures, and railroad men are as eager as ever at the present time to find a substitute for the many kinds of cumbersome and expensive jacks now in use, which will be reasonably cheap at first cost and easy to maintain in service.

Jacks are made in all conceivable shapes, sizes and forms, to meet certain requirements and conditions in the different kinds of engine houses, but generally they are classed as two distinctive types, the one having the telescopic drop section fitting down closely over the stack of the locomotive after it has been placed, and the other having a large flaring section which is stationary, under which the engine may be placed without accuracy, and is larger proportioned in every way than the first named type. The latter named style answers to a greater extent for ventilation on account of its larger dimensions and must necessarily allow the escape of more heat in cold weather unless special arrangements are made to avoid it.

It is well known that the various forms of iron and steel when used for this purpose decompose very rapidly, cast iron being better adapted than wrought iron or steel, but these when made thick enough to last any considerable length of time are cumbersome and expensive and often crack during the first season owing to

contraction and expansion. The sheet iron jacks last ordinarily only two to five years.

Stoneware, or earthenware, commonly designated as tile, has been extensively used for jacks, and a considerable number of such jacks are still in use; but in northern climates they are being gradually abandoned and replaced with other kinds on account of being cumbersome and cracking when being subjected to extreme heat and cold. This form of jack usually consists of several joints of tile mounted upon a roof casting and surmounted by a sheet metal cap, and having either a telescopic section or a stationary hood under the roof, made in either case of iron. This lower section, and the cap, are subjected to rapid disintegration and have to be renewed frequently.

Wood seems to withstand the action of the gases better than metal and it has been successfully used by some roads for many years without any trouble whatever, while other roads experienced loss from fire and many are prone not to use them, fearing similar results.

Attention is directed to a statement made on page 184 of the Eighth Annual Proceedings; wherein a member stated at that time that they had been using wooden jacks on their road for twenty years on every engine house but one (which was equipped with cast iron), and he was sorry that the one exception did not have wooden jacks. He further stated that they use the stationary style (without drop section), and that they did not use any sort of protection against fire in the way of sanding or fireproof paints, being careful in the use of them until they became saturated or coated inside from natural use. Others have used the wooden jacks successfully for years. The committee would therefore earnestly recommend a careful investigation of wooden jacks to ascertain if possible whether the fault has not been in the style or methods of construction and misuse where failures have occurred, rather than in the kind of material. It is quite certain that a wooden jack fitting closely over the mouth of the stack, or nearly so, would be more likely to cause trouble than a large mouthed jack, where plenty of air passes through with the smoke and gases. It is hoped that some valuable information will be brought out in the discussion of this subject in the convention, as a number of our members have had a wide and successful experience with wooden jacks.

Various compositions of asbestos, cement, etc., have been extensively experimented with in recent years for this purpose, many of which proved to be short lived, and none to date have stood the test sufficiently long to prove that they are worth the price which is charged for them, regardless of the fact that they may be guaranteed by the manufacturers for a specified term of years.

The committee can only direct your attention further to the replies received from a number of our members, which are published herewith and form a part of this report.

Respectfully submitted,

M. J. FLYNN,
C. A. LICHTY,
D. L. McKEE,
A. F. MILLER,
Committee.

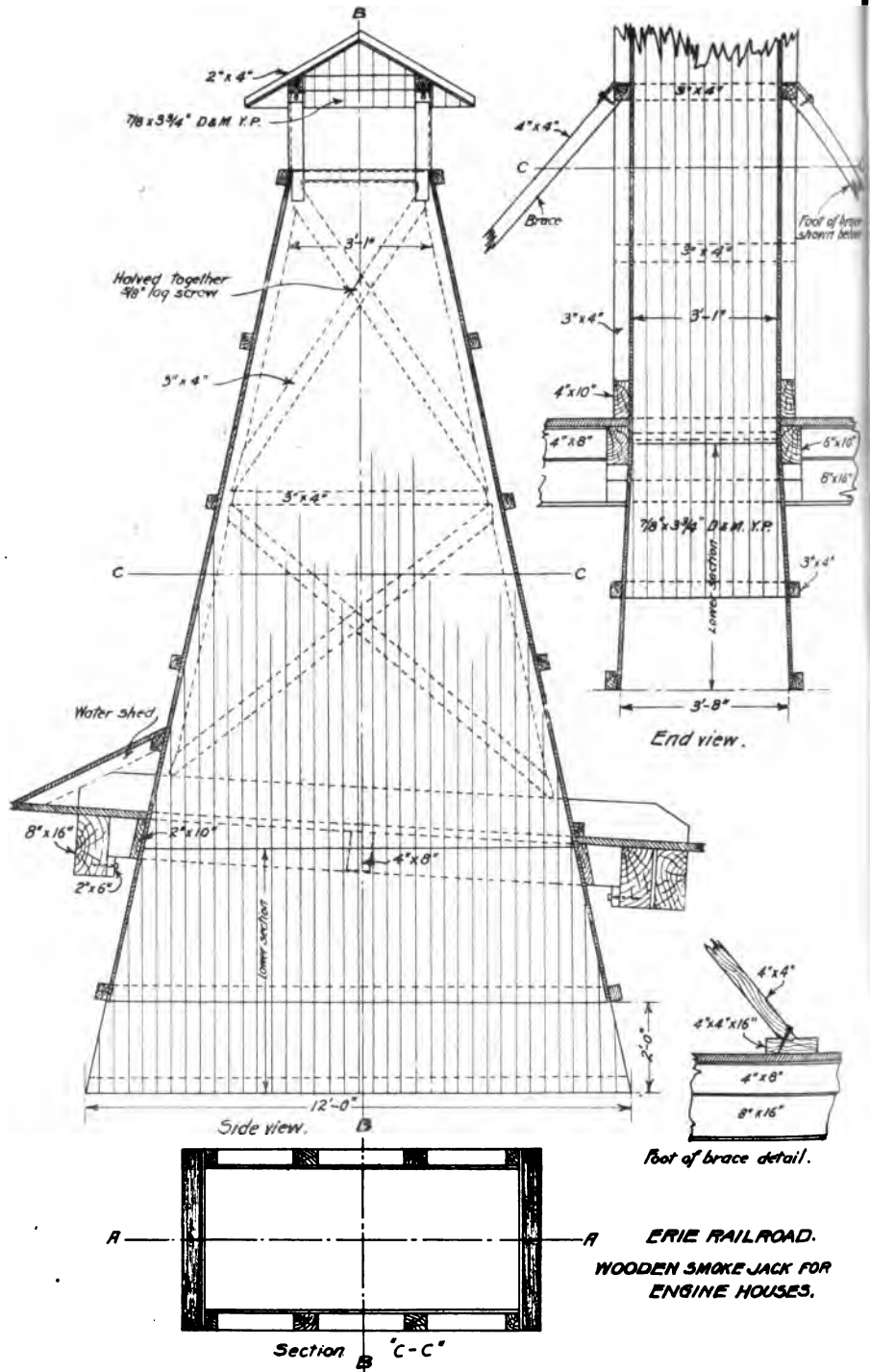


FIG. 25.

REPORTS FROM MEMBERS.

J. F. Parker, Santa Fe Coast Lines:

On the Los Angeles Division they formerly used galvanized sheet iron jacks, which lasted on an average of three years; these were replaced with wooden jacks made of California redwood, which have been in use fifteen years and are still in fair condition. Cost, approximately \$45.

W. O. Eggleston, Erie R. R.:

We formerly used cast iron jacks, but they were not satisfactory either in cost or quality. The Pickering wooden jack has been in use by them for a number of years, but they have lately put into use a number of wooden jacks of their own design which they term the "Erie Standard" wooden jack, and which is shown in the illustration herewith. The standard jack of their own make allows of a variation of 10 feet in spotting the engine and gives satisfaction in every way, having been in use about three years. This jack costs \$100, while the cost of the Pickering jack is about \$35.

O. F. Loweth, Engineer and Superintendent B. & B., O., M. & St. P. Railway:

We are now using on new round houses 24" Dickinson cast iron jacks; these are of the telescope type. We have also used for years past a combination wrought steel and vitrified sewer pipe jack, the steel being the interior section, and the vitrified pipe the exterior section. These jacks have given satisfactory results; their lasting qualities depend largely on local conditions, namely: the extent to which they are subject to gases, heat and cold, and their life ranges from 5 to 10 years. Cost of combination sheet steel and sewer pipe jacks erected \$75, and of the cast iron jacks \$95. Have had no experience with wooden or asbestos jacks.

Judson Joslin, Lehigh Valley R. R.:

We have been using jacks of various kinds, but we give preference to the Dickinson cast iron jack. We have Pickering wooden jacks costing about \$22, which have been in use about seven years and are in fairly good condition, except that the iron screws do not last. The vitribestos jacks after three years of service gave out and their use has been abandoned. These cost about \$27.

E. B. Ashby, Lehigh Valley R. R.:

We use cast iron and improved transite jacks, which are giving good satisfaction. The cast iron will last us about twenty years, but the transite jacks have not been in use long enough to give positive reply, but we have a ten year guarantee on those erected. The cost, of course, varies according to size, and I am unable to give you any definite data in this respect. We have used wooden jacks which did not give satisfactory results, lasting on an average about five years, and the cost of those depended on style and size. The transite jack above mentioned is an improved asbestos board, but the ordinary asbestos or composition jacks lasted only two years when they failed.

F. E. Schall, Lehigh Valley R. R.:

Cast iron jacks properly designed will last about twenty years, and cost in place approximately \$100, depending on the size, owing to the construction and slope of the roof. The transite jacks vary according to conditions from \$80 to \$125. The wooden jacks for the design they used cost about \$50 and lasted only five years. Some vitrified tile jacks were used, but without satisfactory results. The cast iron jacks are of the rigid class (non-telescopic), but the heavy weight which is objectionable has led them to use the improved composition transite jacks, but they have not been in use long enough to give proof of their lasting qualities. He states further: We are now building a round house at Buffalo without smoke jacks, using a long radial reinforced concrete monitor 6' x 24' over each track with louvres. We cannot as yet say whether these will be satisfactory in a northern climate.

J. N. Penwell, Lake Erie & Western (N. Y. C. Lines):

I submit drawing of a wooden jack which was designed to replace an unsatisfactory octagonal wooden jack formerly in use. Their first standard was the old fashioned terra cotta smoke jack placed on a cast iron base, with a flange to fit inside of the tile, and sheet iron section below, in the house, extending about eight inches into the tile. Fourteen of these are still in use, having not cost anything for repairs, except the iron section, for about ten years. The next standard was the cast iron jack, a very neat appearing affair with an adjustable section at the bottom, arranged to raise and lower by means of a cable and pulley. These jacks were too expensive to maintain, did not last well and have all been removed. The next style used was the octagonal shape above mentioned, which has recently been replaced with the style shown in the cut under the title of Lake Erie & Western wooden jack. The approximate cost of this jack in place is \$60, and estimated life, based on past experience, about seven years.

C. F. Flint, Central Vermont Railway:

We use the Pickring wooden jack with a specially designed funnel, making the mouth 5 ft. 3 in. wide and 10 ft. 3 in. long, which gives far better results than the ordinary Pickring wooden jack, with mouth 5 ft. 3 in. square; this style of jack costs from \$18 up, and lasts on an average eight years.

A report from one of the Pennsylvania R. R. men without signature reads as follows:

We use all cast iron jacks, which cost from \$100 to \$150, according to the length required; they fill the bill in a sense, but they are in my judgment too expensive to maintain; after about the third year they require repairs, and often ten years they are so badly disintegrated that it is cheaper to renew them than to make repairs.

J. E. Johnson, Rutland R. R., of Rutland, Vt.:

We use wooden jacks, which give very satisfactory results, lasting from five to twenty years. The approximate cost in place

*DIGKINSON CAST IRON JACK
PENNSYLVANIA R.R.*

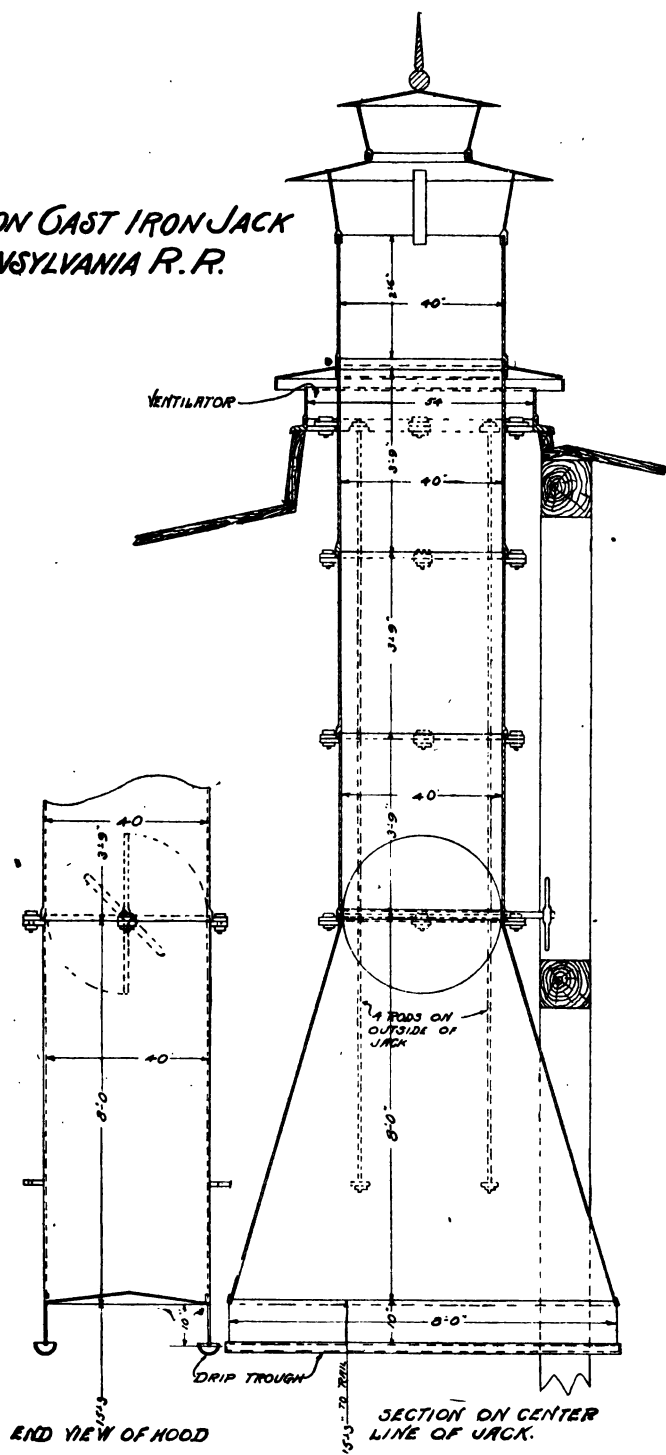


FIG. 28.

is \$28, which includes \$5 royalty. Have never used asbestos composition jacks. On the western road we use cast iron jacks, very heavy, $\frac{5}{8}$ inch thick, and inside of five years they become so badly disintegrated as to be almost useless. The tile jacks, after some experimenting, did not give good service. The cast iron jack costs about \$175, and the tile jack about \$10 in place. Neither are as good as the wooden jack well painted and sanded.

A. S. Markley, C. & E. I. R. R., of Danville, Ill.:

We formerly used vitrified sewer tile for outside jacks, which gave good service, but they cracked in cold weather and were very heavy on the roof. We have been using the wooden jacks for upwards of ten years, giving excellent satisfaction, without renewals in that time. Cost averages about \$15 each.

P. Swenson, Minneapolis, St. Paul & Sault Ste. Marie Ry.:

We have used the Roe cast iron smoke jacks for twenty years with success, requiring but light repairs. These jacks are 20 inches in diameter, of the stationary type, with funnel 4 feet in diameter at the mouth. The cost is \$57 each.

W. M. Noon, Duluth, South Shore & Atlantic R. R.:

We have wooden smoke jacks which have been in use about twelve years and are still in a good state of preservation. The cost is about \$25 each.

J. S. Berry, St. Louis & South Western Ry.:

We use both wooden and cast iron jacks. We give the life of the cast iron jack as three to four years, and cost about \$63. The wooden jacks we use cost about \$20, and give very good satisfaction, lasting from six to seven years and upwards. On some of our round houses we use a continuous ventilator in the roof, instead of jacks, which is a good proposition in a warm climate.

W. F. Steffens, South & Western Ry.:

In reply to your circular, will say that this road is in a state of construction and has not so far built any engine houses. From my experience with the New York Central I shall undoubtedly specify wooden jacks lined with asbestos board. These jacks are light weight, and with the lining should give long and excellent service. The form of a jack to be preferred is one with a widely splayed mouth, in order to obviate spotting the engine accurately in the engine house. There should be an opening between the jack and the roof in order that the gases arising to the roof around the jack may find vent at that point. On general principles I am personally opposed to any form of cast iron jacks for engine houses. They are cumbersome and, if the fastenings fall or are pulled down by a locomotive, they are very dangerous.

J. O. Thorn, Chicago, Burlington & Quincy Ry.:

We use cast iron and tile jacks, but they last only four or five years, and either style carries too much weight for the roof. We have one house furnished with wooden jacks, in use only about a year; it is impossible to tell at the present time the life of the jacks. The cost is about \$30 in place.

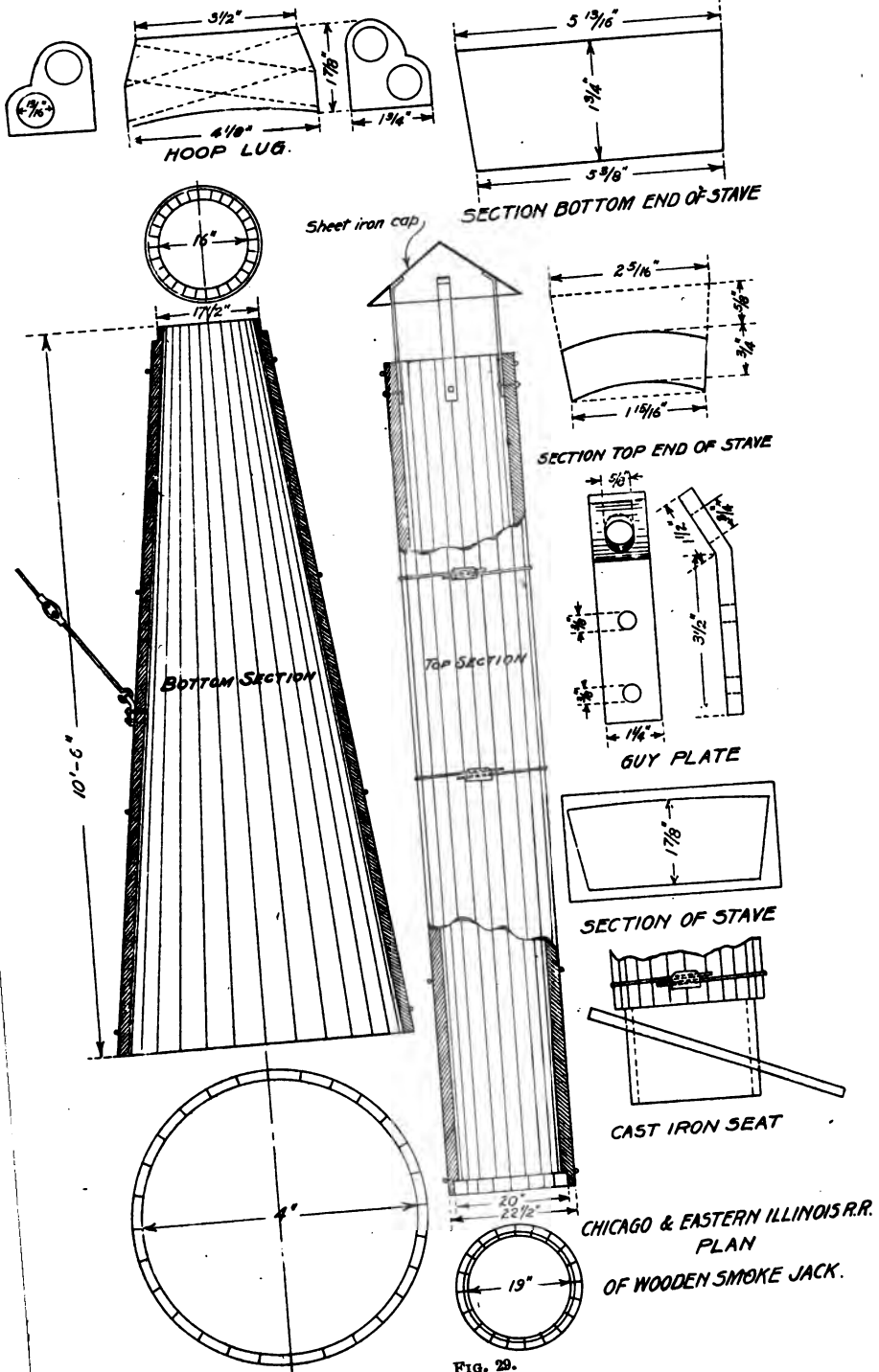


FIG. 28.

C. H. Fake, Mississippi River & Bonne Terre Ry.:

We use the old style telescopic cast iron jacks, because our Master Mechanic prefers them. I am of the opinion that wooden jacks could be thoroughly fire-proofed and by the use of the fire-proofed pins, instead of nails, would make an ideal jack. Wooden jacks not fire-proofed seldom catch fire, but you cannot make an insurance agent believe it.

J. B. Brown, Kansas City, Clinton & Springfield Ry.:

We use Dickinson cast iron and vitrified tile smoke jacks. The Dickinson jack needs no introduction, as they are quite extensively used; we have not been using them long, hence I am unable to say how long they will last. We have been using the tile jacks on two of our houses for twenty years and they are apparently as good as ever. They consist of three sections above the roof, each 2 ft. 6 in. long by 18 in. wide, inside diameter, set on cast iron roof casting, with sheet iron section below the roof, which flares out to 4 ft. in diameter at the bottom, having drip troughs which connect with an inch pipe running to drain or sewer. These jacks cost approximately \$75. I think they are the best all round jacks in use today.

H. H. Eggleston, Chicago & Alton R. R.:

We have used both cast iron and square wooden smoke jacks. They have both given good results. As to the length of time they will last depends upon the weather and use they are subjected to. On one house we had three jacks blown down in a week by a severe wind storm. These were on a quarter pitch roof and were 18 ft. high. On this same house we have two wooden jacks which have had severe usage for six years. The cast iron jacks on one of our houses have been in use ten years, but have become broken in different places and are being replaced with wooden jacks. We are now putting six Dickinson jacks on our new house at Brighton Park, Chicago, at a cost of \$96 complete. These have hood openings 3 ft. by 8 ft. The wooden smoke jacks are as satisfactory as any we have used, except that occasionally one catches fire. This road has never used any composition jacks.

B. F. Pickering, Boston & Maine R. R.:

We use mostly terra cotta jacks, with a cast iron bell section below the roof, which are reasonable in cost, and some of them have been in service twenty years and are yet in fairly good condition. Have one house equipped with wooden jacks which have been in service about ten years, and in that time have been rebuilt above the roof and are not in first-class condition now.

J. P. Canty, Fitchburg Division, Boston & Maine R. R.:

Dickinson cast iron jacks are now generally being put into use by the company where new jacks are installed, and cost approximately \$60 in place. We have not used them long enough to determine the length of time they will last. We have used the Pickering wooden jacks and have also had some of our houses fitted with wooden monitors on roof over pit, varying in length from 8 ft. to one-half the depth of the house. Where these monitors were used no regular smoke jacks were installed. They

did not keep the house clear of smoke and steam by any means, and a great deal of heat escaped through them, in fact, they were very unsatisfactory all round. The Pickring wooden jacks lasted only about a year in our busy houses, and although the monitors as constructed by us lasted three to four years, we considered that both were failures. We have no record of the cost of the monitors, as they were built with the remainder of the roof; the wooden jacks cost about \$35 each. One engine house where it is obligatory to carry smoke above the adjacent buildings, is equipped with "transite board" stacks which are forty feet high above the roof. The light weight of this board, which is an asbestos composition, had to do considerably with the decision to use this kind of material. Light steel angles are used at the corners, and the transite board is drilled and bolted to the angles with ordinary machine bolts. Angles were painted before assembling and after erection of smoke jacks. The heads of the bolts were covered with asbestos cement, but probably on account of the cold weather when the work was done the cement did not stick. It is our intention to apply the cement once more in warmer weather in order to give it a fair trial. Otherwise these jacks seem fairly well suited for the purpose, although they have not been in use a sufficient time to predict how long they will last. They cost in place about \$300 each. From our standpoint a cast iron jack is as cheap as a tile jack of approximately the same size and shape; the cast iron jack is fully as efficient and will last longer.

F. Ingalls, N. P. Ry., Jamestown, N. D.:

Up to two years ago we used Dickinson cast iron drop hood jacks; these were satisfactory, with the exception that the average life was only three to four years. We are now using a wooden jack painted inside with asbestos cement and lined with one-half inch cement mortar applied on expanded metal lathing. This cement coating is not giving satisfaction on account of the fasteners giving way, and the concrete buckling and cracking due to expansion and contraction. Another serious difficulty which we experience here is that a great deal of heat escapes through these jacks, when the mercury drops to forty-eight degrees below zero, and I have found it necessary to put sliding gates on the under side of the jacks to retain the heat when the jack is not being used. We experimented some with tile jacks, but their use has been discontinued.

James Hartley, Northern Pacific Ry., Staples, Minn.:

Cast iron jacks are too expensive and too short lived. Have experimented with vitrified pipe for that portion above the roof and they seem to be very durable. We have had them in use for six years and they show no deterioration whatever. In 1906 we installed thirty wooden jacks as per sketch enclosed. These are made of wood and lined inside with cement on expanded metal. (See cut.) They seem to be all right so far, but I can say nothing as to the probable life of them. They cost in place from \$30 to \$40.

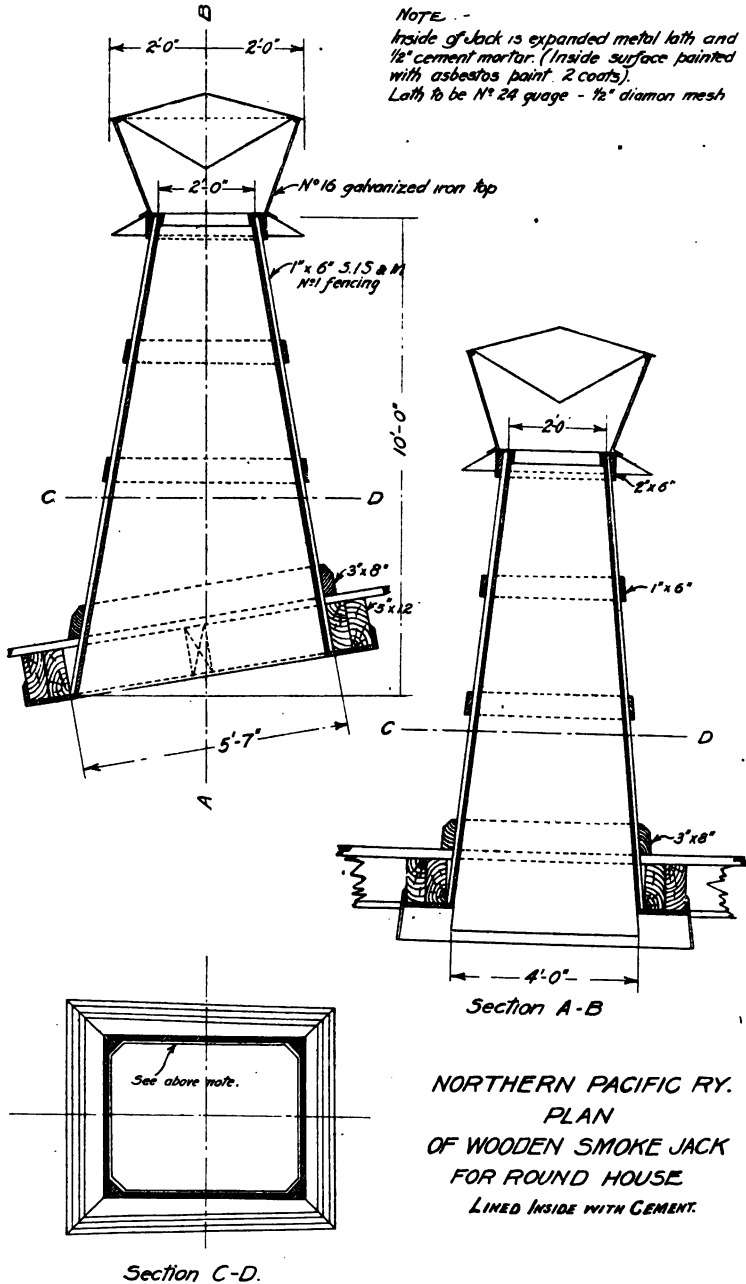


FIG. 30.

D. L. McKee, Pittsburg & Lake Erie R. R.:

We have in use on our road two houses equipped with jacks made of No. 10 sheet steel, U. S. standard gauge, with a hood 3 feet wide, 5 feet high at center, and 14 feet long, tapering up to a 30-inch stack, sides extending 18 inches below ends and supplied with a drip trough for the catching of moisture. These have been in use four years, and have given satisfactory results so far, requiring no repairs except necessary painting.

We have in use five engine houses equipped with wooden jacks. These have given good results, although they have not been in service long enough to determine their lasting qualities. They are very satisfactory in keeping the houses clear of smoke; also allowing the engine a greater latitude on account of the long hood. They cost approximately \$300.

Previous to the installation of the jacks now in use we have had some experience with cast iron drop jacks and found it very difficult to keep the houses clear of smoke, on account of not being large enough in diameter, clearly demonstrating the fact that the larger the engines, the larger the capacity of the jacks should be.

We also experienced some trouble in maintaining these jacks, on account of failure at times in raising hood before moving engine. We have had no experience with asbestos and composition jacks.

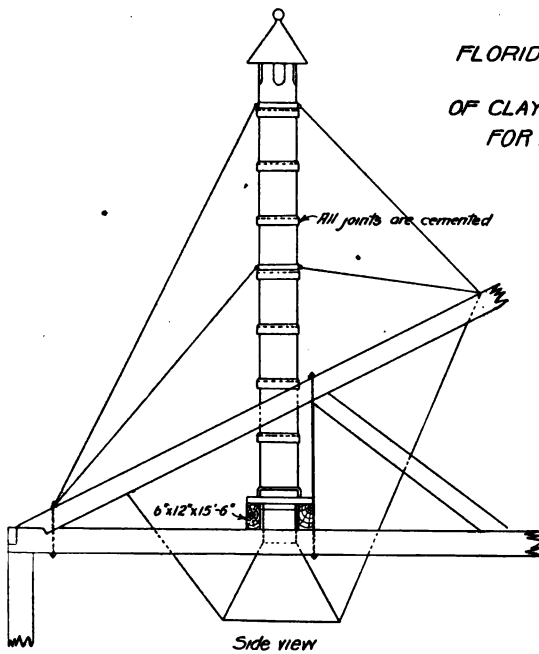
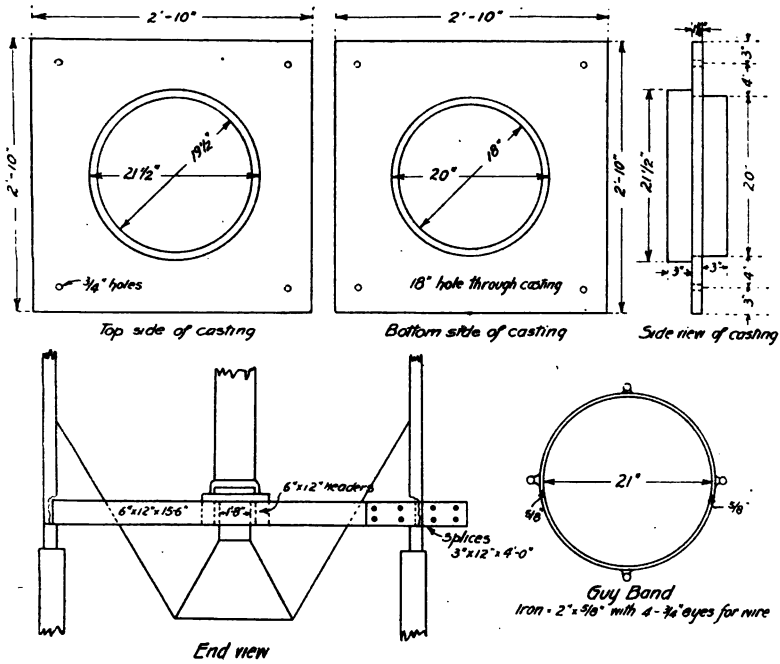
E. K. Barrett, Florida East Coast Ry., St. Augustine, Fla.:

In 1903 we equipped all engine houses on this road with 18-inch salt glazed terra cotta smoke jacks, as per plan herewith, pipe and ornamental top made by Stevens & Company of Macon, Ga. These are equipped with galvanized turn buckles, copper wire guys and copper sheet funnel; the entire outfit is giving entire satisfaction, with no repairs necessary in the four years' service to date, and apparently as good as ever. During the first six months after they were erected there was some complaint on account of dripping, but the trouble seems to have disappeared. These cost in place approximately \$50 each.

W. H. Finley, Asst. Chief Eng., Chicago & North Western Railway Co.:

The Chicago & North Western Railway has used mostly "Dickinson" pattern cast iron jacks of the drop pattern. They last from one to three years, and cost approximately \$75. A few fixed iron jacks have been used and it was found that their average life was somewhat longer than the drop jack. A few wooden jacks have been tried with satisfactory results in every way, but their use has not been extended owing to the fire risk being considered too great. These were built with wide, funnel shaped lower section and cost about \$30. This road did not have any trouble with fire in connection with these jacks.

The engine houses now under construction at Janesville, Wisconsin, and Pierre, S. D., are to be equipped with forty-six jacks made of asbestos board. These will be of the rigid type, with bell-shape lower end, 3 x 10 feet, approximately, and will permit considerable latitude in spotting engines. Cost will be in the neighborhood of \$100 each.



FLORIDA EAST COAST RY
PLAN
OF CLAY PIPE SMOKE JACK
FOR ENGINE HOUSE

FIG. 82.

*DICKINSON
CAST IRON JACK.
B. & O. R.R.*

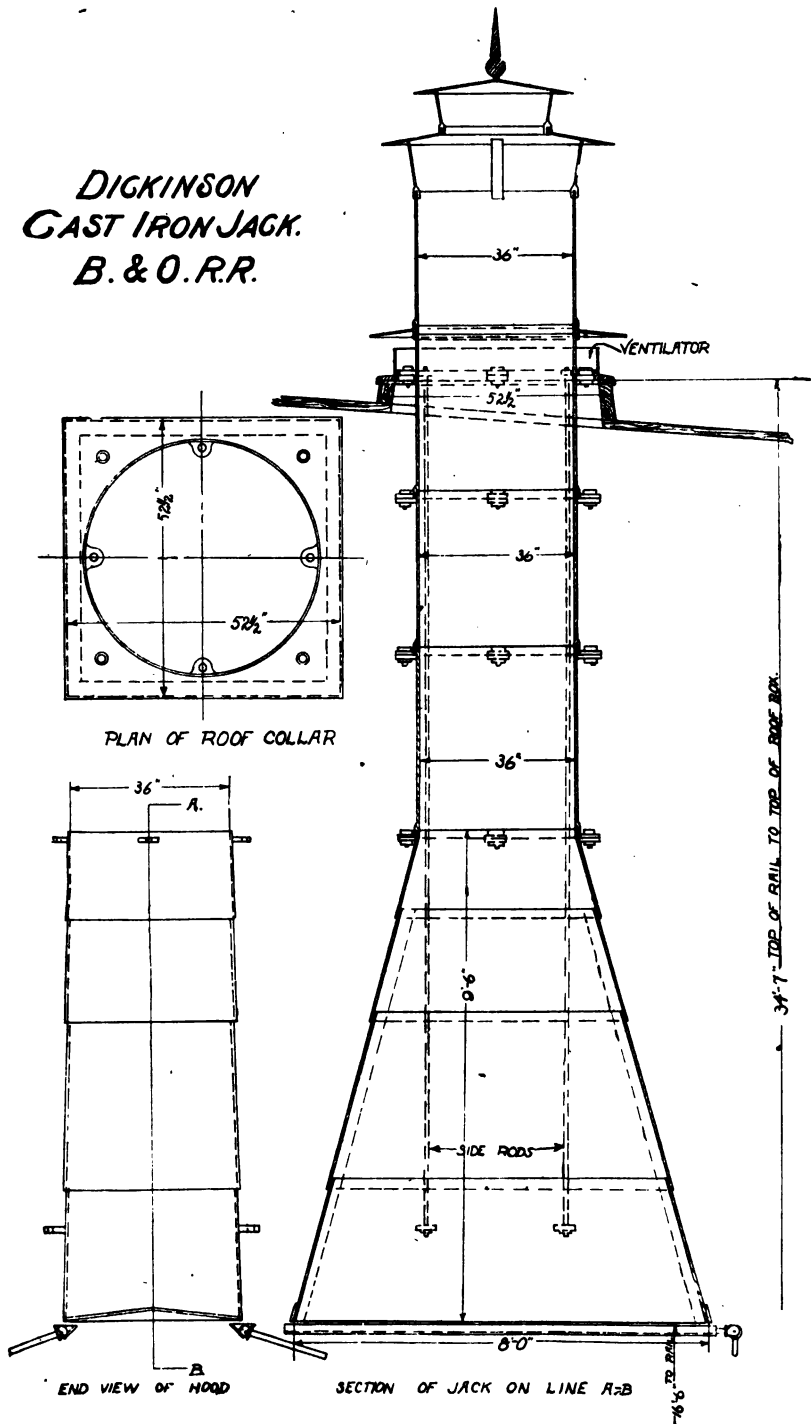


FIG. 84.

The new engine house at Huron, S. D., will be furnished with forty wooden jacks, lined with 3-16-inch thick asbestos board, which will be furred away $\frac{3}{4}$ inch from the exterior wooden casing. The stack will be provided with a damper to prevent loss of heat when jack is not in service and it is expected that this will be very necessary during the severe winter weather in that section of the country. Cost will be about \$100 each.

Three years ago we placed in one stall of our round house at

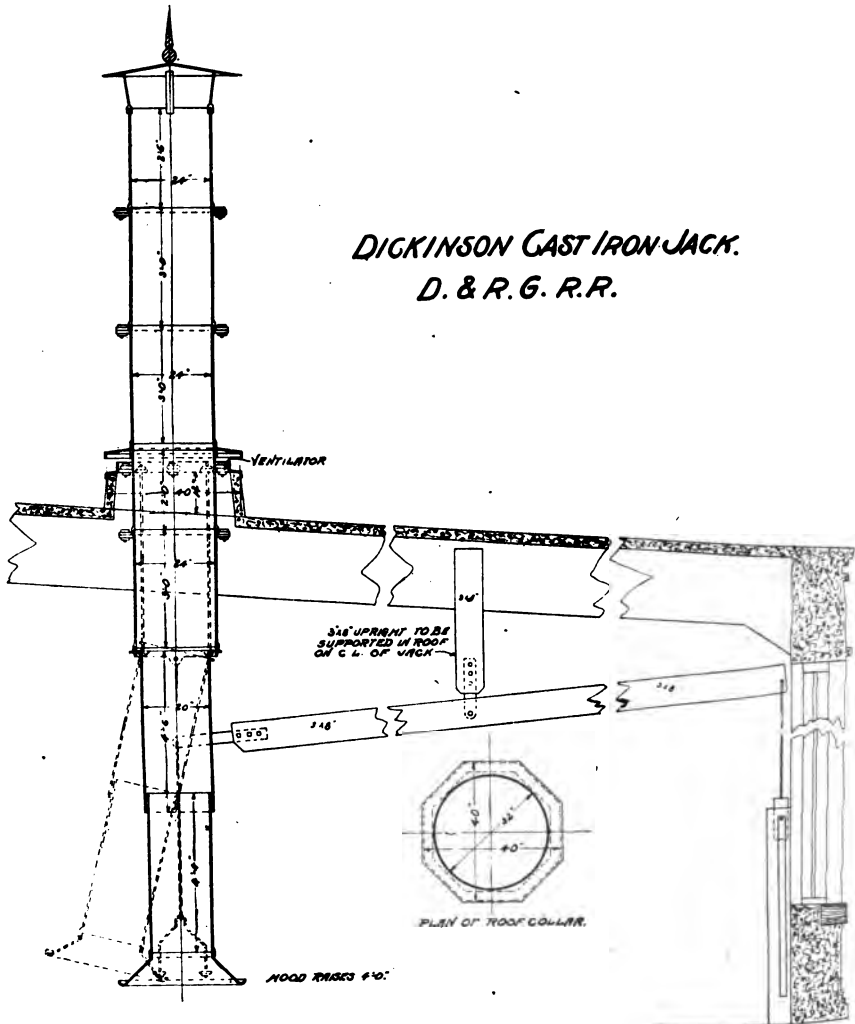


FIG. 35.

Chicago Avenue, Chicago, a vitro-bestos jack, and it has given excellent satisfaction and is still in good state of preservation. It has worn out one set of cast iron jacks and one set of galvanized iron jacks. This house is located in a congested spot and the gas and moisture hangs close to the house at all times. They handle something like 8,500 engines per month in a 29-stall round-house. The master mechanic of this house says, in speaking of this jack, "I cannot say too much for this vitro-bestos jack." After this jack was installed the company put up a number of other vitro-bestos jacks at other points, but they all proved to be a failure. I am satisfied that if this vitro-bestos is properly and uniformly baked that it would make a satisfactory jack, as far as lasting qualities are concerned. It is light in weight and can be molded to any shape you wish, doing away with the angle and bolt or rivet fastenings necessary in the other form of asbestos board jacks. I understand that the parties now making this material have greatly improved their facilities for properly and uniformly vitrofying the material.

DISCUSSION.

Mr. Lichty.—In reading the report I did not include the replies which were received from the members to whom circulars were sent. The majority of these replies seem to favor the wooden jack. The committee would be in favor of continuing the subject another year, as much additional information might be gathered which could be put in tabulated form. Railway managers are investigating this subject thoroughly and we desire to bring out the details as fully as possible. We would call attention particularly to the large wooden jack of the Pittsburg & Lake Erie Railroad, which is illustrated in the report. It is in two sections and answers largely as a ventilator. Some of the wooden jacks are very simple in construction and are built at a cost not to exceed fifteen dollars. The committee would like to have this subject discussed as thoroughly as possible.

A. S. Markley.—We have been using wooden jacks since 1896. I much prefer them for economy and durability. However, we have had no experience with asbestos jacks. It may be possible that they will be better and more durable than wooden ones, being still in their experimental stage. Time may bring about better results than can be ob-

tained with wooden ones at the present time. From long experience metal jacks are not considered practicable so far as economy and durability is concerned.

A. S. Markley.—Wooden smoke jacks were first put up in 1898 on the C. & E. I. Road. The drawings are produced in the eighth annual proceedings, page 118. All of our engine houses are equipped with this class of jacks, with the exception of the new part built this year. There are seventeen stalls where we are putting on the asbestos jacks manufactured by the Johns-Manville Company. The cost was about \$100 plus cost of installing, which is about \$25 per stack. We have found in some cases that the soot accumulated on the top of the inside "jack," where there is a shoulder of about three quarter inches in thickness, where jack is inserted into a cast iron thimble, which gave us some trouble in a few cases. To overcome this we reversed the connection at the thimble by putting the jack on the outside of the thimble, leaving no shoulder there for the soot to lodge on, to catch fire. That was the only difficulty we experienced. We have about 150 of them in service on our road at this time. It is impossible of course to keep an engine house clear of smoke under all conditions. The weather conditions have more to do with it than the jacks. Where the atmosphere is heavy the smoke will hang over it and is impossible to clear it out. I have noticed that in recent constructions the ventilators on round houses are somewhat overdone, more particularly in cold climates, wherein all the heat will escape through these ventilators, leaving the house cold. Provisions should be made to close them in cold weather. Another feature in this connection is the blowing off of boilers and of allowing engines to blow off steam while in the round house. Special provisions should be made to blow all steam through pipes to the outside of building, which can be done at small expense. More damage is done to buildings from this source than any other, roof boards swelling, damaging the roof and sweat forming inside, making it for a time almost as

disagreeable as rain would be on the outside. In some cases roof boards have swollen so that damage was also done to the fire wall, besides being unhealthy for the men who are compelled to work in the house under the most disagreeable circumstances, preventing them doing what they should do where conditions are more favorable. We use no paint on the jacks whatever. We rely upon the crust formed by soot and steam together from the locomotives, which soon forms on them, and prevents them from catching fire. It is impossible to set them on fire with sparks from the locomotives, if the inner surface is smooth, leaving no place for cinders to lodge. After jacks are in service a short time the bands should be tightened where staves have shrunk on account of heat from the locomotive shrinking them and thus opening the joints.

Mr. Large.—What is the cost of your wooden jacks, Mr. Markley?

Mr. A. S. Markley.—Those that we built cost about \$16 apiece. The price of lumber since that time has increased, but I believe \$20 to \$25 would cover the cost now.

Mr. Perry.—Speaking of wooden smoke jacks, we used them years ago. I never knew one to take fire while we were using the same. Since that time, we have put up new engine houses, using mostly cast iron smoke jacks. Of course, we have had more or less trouble with them on account of rusting off. We have replaced some of them with wooden ventilators instead of the smoke jack. I prefer a good wooden smoke jack in place of one of cast iron.

Mr. Joslin.—I would like to ask what the experience has been with the bands around the stack on the outside.

Mr. A. S. Markley.—They will last from eight to ten years, and the cost of renewing them is very small.

Mr. Joslin.—What size rod do you use?

Mr. A. S. Markley.—Five-eighths inch. They will last about ten years and I presume fifteen to twenty-five cents would renew one of them.

Mr. Parker.—I would like to have the gentleman inform

us in regard to painting on the inside of these wooden jacks.

Mr. A. S. Markley.—Mr. President, I have just explained that matter, but I will again state for the benefit of Mr. Parker that we do not paint them at all on the inside or outside. The steam or dampness and the soot from the engines soon forms a crust on the inside and we rely upon that. That protects them. Paint will not resist the elements.

Mr. Canty.—We erected some very tall “transite” smoke jacks on one of our engine houses about a year ago, because jacks of the ordinary height would not deliver the smoke high enough to clear the tops of the houses nearby. The engine house is situated in a very good residence locality. People in this district seriously objected to the amount of smoke distributed about their houses, so in order to carry it up quite high above the tops of the houses, we put up something like a chimney on top of the engine house, over every stall. There were ten stalls in the house. The conclusion we arrived at was that “transite” material would be the most suitable for this construction. We assembled those ourselves. The greatest trouble we had with the “transite” jacks was in covering the bolt heads on the inside of stacks, so as to protect them from corroding. We first used a cement preparation, which the manufacturers of the “transite” board prepared for us when jacks were erected, which was in the winter time. This cement would not stick; it kept dropping down over the smoke stacks of engines in large quantities; also smeared the fronts of the engines and made a mighty disagreeable mess. We took the matter up with the people who furnished the cement and they sent us an additional supply. This was applied last summer. I think the trouble with placing the cement previously was that it was put on in extremely cold weather. The manufacturers said it made no difference what the weather was when applied, as it would stick anyway, but we know it did not stick when put on in cold weather. It seems to be necessary to apply the

cement in warm weather, or in a warm building. So far this second application appears quite successful. These are extremely light-weight jacks for the size and appear to stand the action of the steam and gases very well.

Mr. W. O. Eggleston.—I would like to ask the members to turn to page three and look over the jack as used on our line. On that page is the reproduction of the blue print; it has shown the bracing as being on the inside. This is a mistake, as the sheathing is entirely on the inside, making a smooth surface. You will also notice an opportunity is given for the movement of an engine of about ten feet; that is one of the best features of the jack and we are very well satisfied with it. We now have these jacks on nearly every house on the Erie System and they are giving the very best results. No complaints from anybody. They cost about \$100 each. I hope you will not think for a moment that this bracing is on the inside, as that mistake was made in the tracing of the blue print. It has a plain, smooth surface sheathing on the inside. I would like to mention another thing and that is, I would suggest the use of copper nails or composition nails in the construction of any kind of a wooden jack, because the ordinary steel nails will not last, while the copper or composition mixture will give very much better service.

Mr. Clark.—Through the kindness of Mr. Eggleston some two or three years ago, I was furnished with a blue print of his wooden jack screws. I made a couple of them and after they were erected and put on the engine house about three years ago, the division engineer thought that it would be well to line them with asbestos on the inside. Personally I do not think any lining is needed. We use common yellow pine ceiling without the beading, and put on as shown by the print perpendicularly and we did not paint it; and that matter also came up in probably a month after they were erected, about painting them on the inside, but when we came to examine them it was found that the dampness and soot from the engines had thoroughly coated the

inside of the jacks. I might say also, Mr. President, that on one of the round houses on my division we have twenty eight of the Dickinson cast iron smoke jacks, which is the Baltimore & Ohio standard, and while they are a good article when new, yet they are expensive to keep in repair; and while I haven't the exact figures, I think it would be a fair estimate to say that it costs from \$1.50 to \$2.00 per jack per year for repairs. These wooden jacks which I have now had on for nearly three years have not had any repairs as yet.

Mr. W. O. Eggleston.—In the matter of maintenance, as I said before, I think a composition nail should be used in the construction of jacks, as it will certainly tend to lengthen the time when the repairs become necessary, because no steel nail will amount to anything. The gases will eat it up in a year or two.

Mr. Penwell.—You will notice on page 7 of this report that we have shown a sketch of the Lake Erie & Western smoke jack, recently adopted as stated in my letter to this committee. We adopted this because of the economy in building it, and so far it has been giving good satisfaction. In a conversation with the assistant chief engineer of the Lake Shore road recently, he told me that he thought they had the smoke jack problem thoroughly solved by using an asbestos-lined jack, and if Mr. O'Neil of the Lake Shore is present I should like to hear from him relative to the same.

Mr. O'Neil.—In answer to Mr. Penwell, would say that the jacks referred to are not on my territory, and while I have seen these jacks I don't know very much about them; but if our chief engineer stated that the jack problem had been solved, with all due respect to him, I will say that I think he is talking through his hat. We are still trying nearly everything. Two years ago on the Toledo, Ohio, thirty-stall house, they used cast iron jacks, but they are very expensive and they are also very heavy to carry on the roof. Our jacks are forty inches in diameter and forty inches seems to carry away as much smoke as will go out in

fair weather, and in bright weather, when the smoke will ascend, we have no trouble in keeping our house warm. We do our heating with condensed steam from the stationary boilers, largely mixed with hot water.

Mr. W. O. Eggleston.—One thing the members should bear in mind is the diameter of the round house jacks. There is an immense volume of smoke that rises up and a good portion will drift down into the house if jack is not large enough; but if you have a jack that is large enough, it will clear itself much better. I do not think that any part of the smoke jack should be less than three by three feet, or even larger at the extreme narrow point.

President.—Any further remarks on this subject? If not, we will close this discussion and take up number six.

VI.

COMBINATION FASTENING AND LOCK FOR ROLLING AND SLIDING DOORS ON FREIGHT HOUSES AND OTHER BUILDINGS.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

The various styles and sizes of doors on the different railroad buildings require a variety of locks and fastenings. Simplicity and cost are the two main items to be considered, yet the importance of security and effectiveness must not be lost sight of in connection therewith. As a general rule the simpler the contrivance the easier and cheaper to maintain, and often more effective than those more complicated and expensive.

The Committee finds that it is generally the custom, in the case of a large freighthouse or warehouse, where there are a number of doors, to fasten all but one door from the inside, and the exit door, whether it be one of the large doors, or a small door leading to the office, secured in some way from the outside. If one of the larger doors be used as a final exit, it is generally fastened with the ordinary hasp and staple with common padlock. In case a small door is used it is customary to fasten it by methods used on all ordinary small doors.

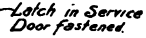
Horizontally rolling or sliding doors, fastened from the inside, are usually locked by placing a pin in a hole in the back of the door in a post; or common hook and staple or box car door fastener, or other simple contrivance holding the door to the front post.

Vertically sliding doors or those raised and lowered on pulleys require a hook or lever fastening which may be very simple in its design. One of these fastenings used by the C. & N. W. Ry. is shown in the illustrations.

Kinnear doors, or curtain overhead rolling doors, raised and lowered with a chain, are fastened by simply blocking the chain in a slot with a nail.

Knee doors are fastened at the side near the knee joints, by any means holding it to the posts, which ordinarily consist of a lever similar to those on a large refrigerator car door, or a door bolt attached to the door and fastened to the posts.

Engine house doors are most commonly held in place by use of the old style wooden cross bar, extending from post to post, and the doors fastened to these by use of hooks. We furnish plan showing method used by the Chicago, Milwaukee & St. Paul Ry., which is claimed to give good service. This style of fastening holds the door at two places, one well towards the top, which is a good feature. The committee would call attention to the door



Chicago & North Western Railway.
Latch for Vertically Sliding Freight House Door.
MILWAUKEE, CAL.

FIG. 36.

fastenings illustrated on pages 242, 246 and 247 of the Fourteenth annual proceedings, of the convention held at Chicago in 1904, under subject, "Best Freight and Round House Doors and Fittings for Same." It consists mainly of a device for holding the doors closed at the top securely, and is used by the Baltimore & Ohio, Wisconsin Central, Chicago & Eastern Illinois, Chicago & North Western and other roads.

Freight rooms and express rooms which have but one rolling door are sometimes locked with a combination lock and fastening, the fastening being a projecting hook which, when the door is closed, catches in a mortised plate set in the wall, or rather in the post, and is unfastened with an ordinary key being inserted in the lock from the outside. Another design which is stronger is illustrated herewith, and is used by the Boston & Maine Ry., which consists of an ordinary hook latch, unfastened from the outside by throwing the bolt of a rim dead lock with the key. This design is furnished by Mr. Pickering, and perhaps comes as near as anything shown by the Committee in this report which deals directly with the subject, technically speaking. The opinions given in the letters from the members do not vary greatly, a few of which we quote following.

C. H. LICHTY,
H. RETTINGHOUSE,
J. L. TALBOT,
W. T. POWELL,
Committee.

LETTERS FROM MEMBERS.

C. F. Loweth, Chicago, Milwaukee & St. Paul Ry.:

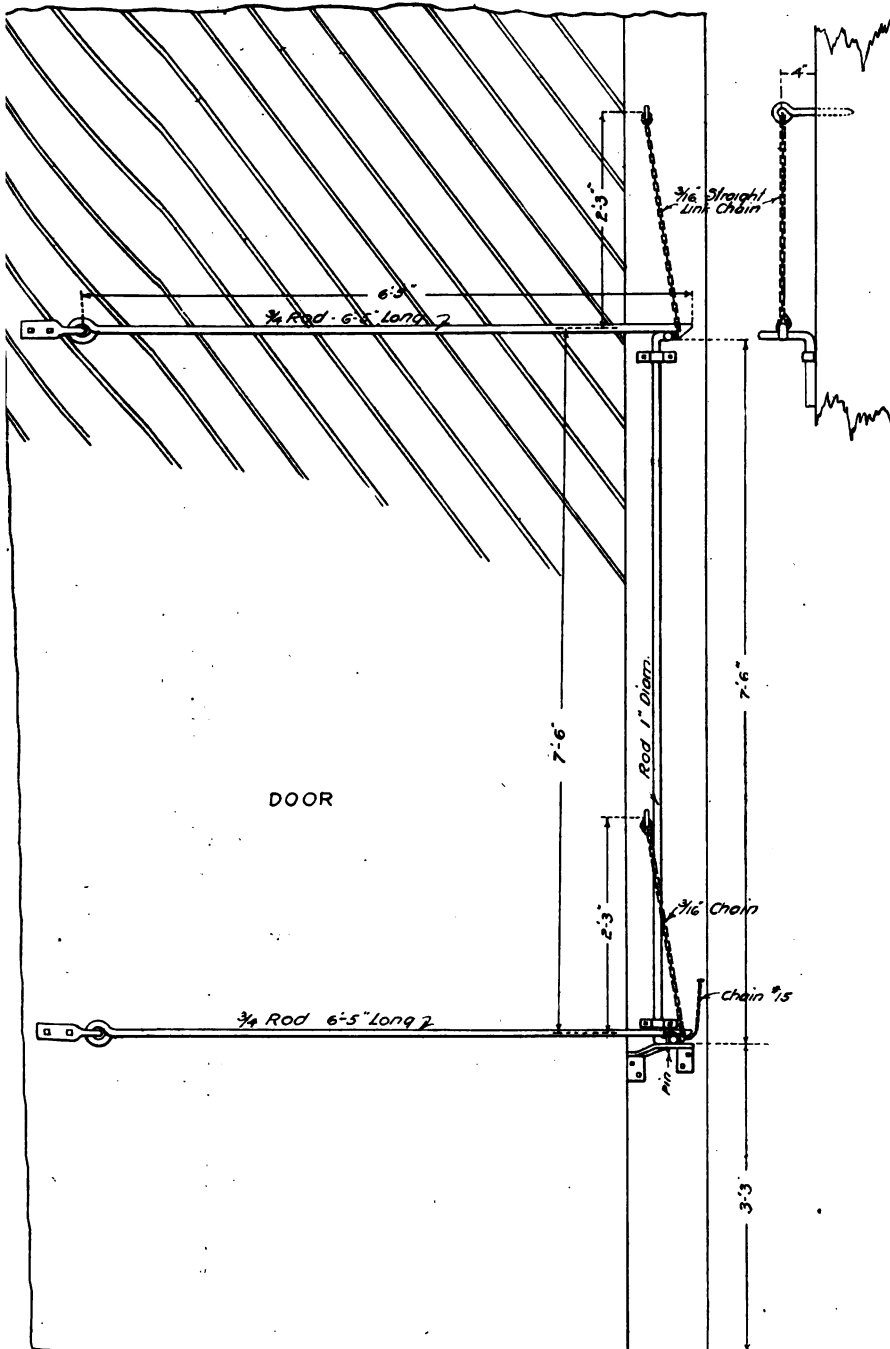
I am sending you a drawing showing detail of our round house door latch which we have used for the past two or three years, and is considered the best latch which we have yet used on our round house doors.

J. P. Canty, Boston & Maine R. R.:

Our arrangements for fastening doors of freight houses are very crude. In fact, it may be stated that we have nothing to offer worth mentioning, which will show how our freight house doors are fastened. All of our freight houses have at least one small door which is fitted with ordinary style of mortise door set furnished with a key. The large doors are of the sliding pattern on overhead rolling hangers. These slide in one direction only and a wooden pin fitted into a hole bored in studding to which door frame is attached on other side of door, completes the arrangement. As there has never been a demand for other arrangements with us, we take it for granted that this simple fastening fills our requirements.

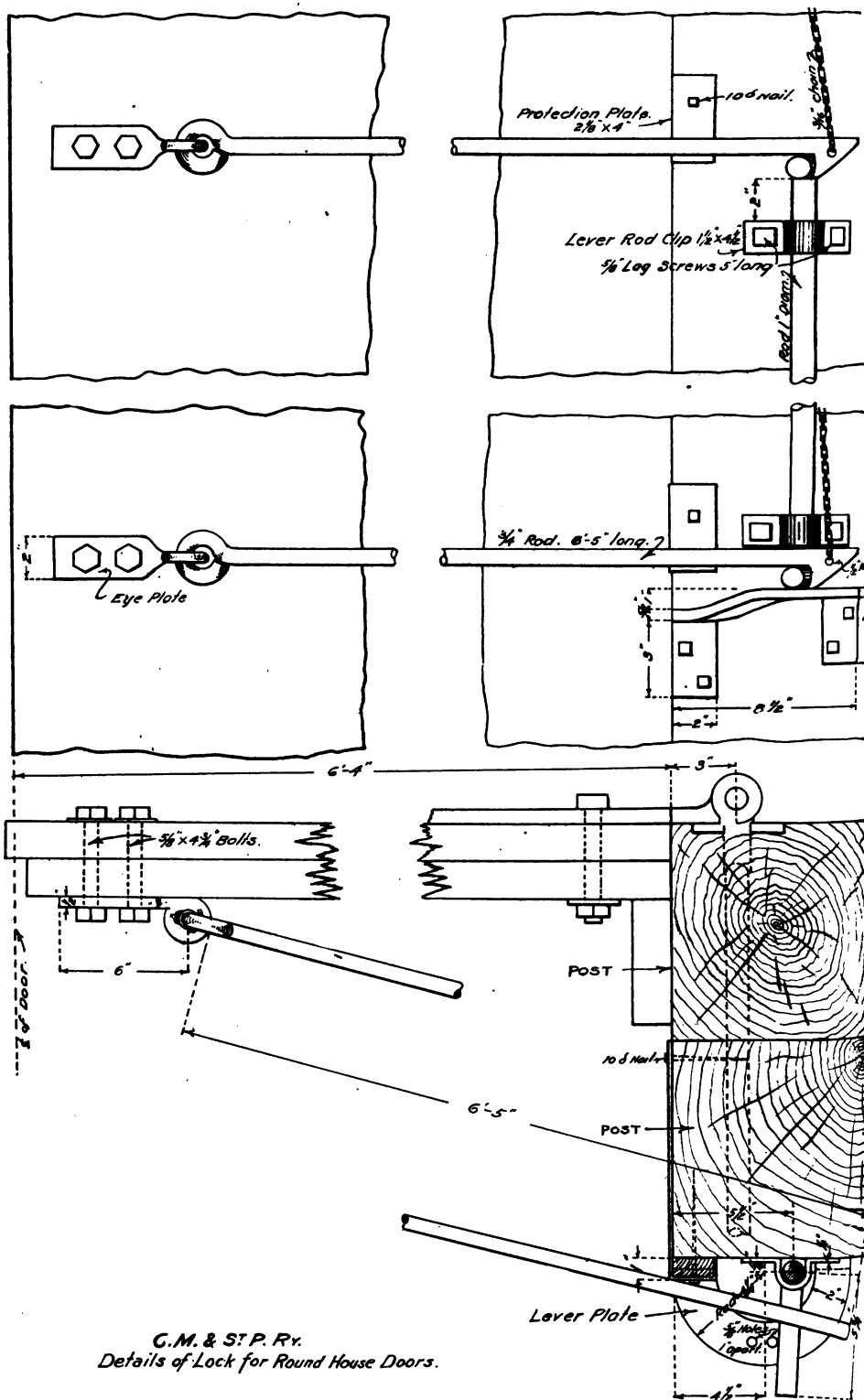
B. F. Pickering, Boston & Maine R. R.:

I have with one exception no locking device worth reporting for the convention. On several baggage and express rooms we use a device which I designed myself, general plan shown in drawing attached, which gives excellent satisfaction. The lock shown is a Harvard rim dead lock, No. 360, made by B. & F.

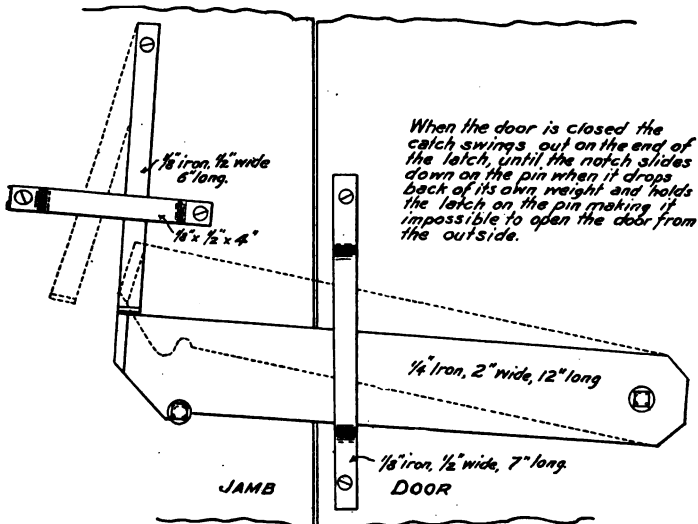


C. M. & ST. PRY
LOCK FOR
ROUND HOUSE DOOR

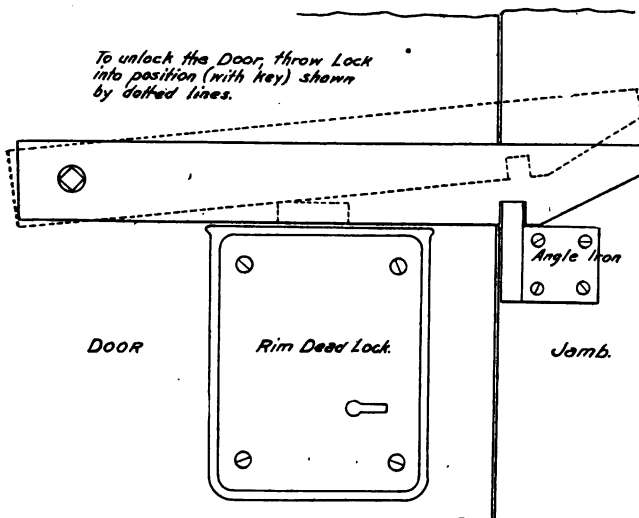
FIG. 37.



G.M. & S.T.P. Ry.
Details of Lock for Round House Doors.



INTERCOLONIAL RAILWAY,
Fastening for Sliding Doors on Freight Houses.



BOSTON & MAINE R. R.
Door Fastening,
Unlocked from Outside.

FIG. 89.

Corbin, New Britain, Conn., but any ordinary rim dead lock can be used equally as well. I can recommend this to any one needing anything of the kind.

C. H. Fake, Mississippi River & Bonne Terre Ry.:

I have used several patented devices for securing sliding doors, but none of them satisfactory. I have found nothing as sure, that will not injure the doors, that will hold as well and cause as little call from the station agent for attention, as a good heavy hinge hasp and plate, the former bolted with carriage bolts, heads outside, the latter fastened on with screws. An agent who is responsible for freight had rather have such a device that is sure, even if he has to whittle a peg or hunt up a spike or a nail to keep the hasp from flying off the staple, than risk some complicated supposed safety automatic affair that generally closes and sometimes does not. The above refers to freight room doors closed and fastened from the inside.

B. J. McKee, Illinois Central R. R.:

In addition to the ordinary mortise knob lock, store door handle and thumb latches, we use the Lincoln or Yale spring night latches, which are easily put on, and cost from \$.60 to \$1. These will last with ordinary care four to five years, on freight and ticket offices, which require automatic and positive locks. Our freight room doors are locked on the inside with hinge hasp, hook and staple, or cross bar.

J. N. Penwell, Lake Erie & Western Ry.:

We use no elaborate door fastening of any kind. Usually the simplest safe method of fastening doors is the best. We have a number of lift doors hung on weights which are fastened by means of a hook which is set at such an angle as to make them secure. Our sliding doors are fastened with the latest pattern of the Dayton car door fastener or hasp. After trying a number of various kinds of fastenings for sliding doors we have adopted this car door fastening, as it is the simplest, cheapest and most secure.

W. T. Powell, Colorado & Southern Ry.:

We have no special fastening for doors except for depot waiting room doors. We have had considerable trouble in getting locks that would stand the wear and tear which they are subjected to. We are now using a lock similar to a coach lock, having them made both right hand and left hand. On freight house sliding doors we use a hinge hasp on the inside. On round houses we use the horizontal wooden cross bar, which is quite common. On several of our freight houses we have iron rolling doors. Most of these are of the Kinnear pattern, and are locked by fastening the chain which raises and lowers them.

J. S. Berry, St. Louis & Southwestern Ry.:

On this road doors on freight houses are fastened on the inside with heavy hinge hasp and drop pin, and outside doors with heavy thumb latch and night lock. On office and waiting room doors I have tried almost all kinds of locks, and I have found that

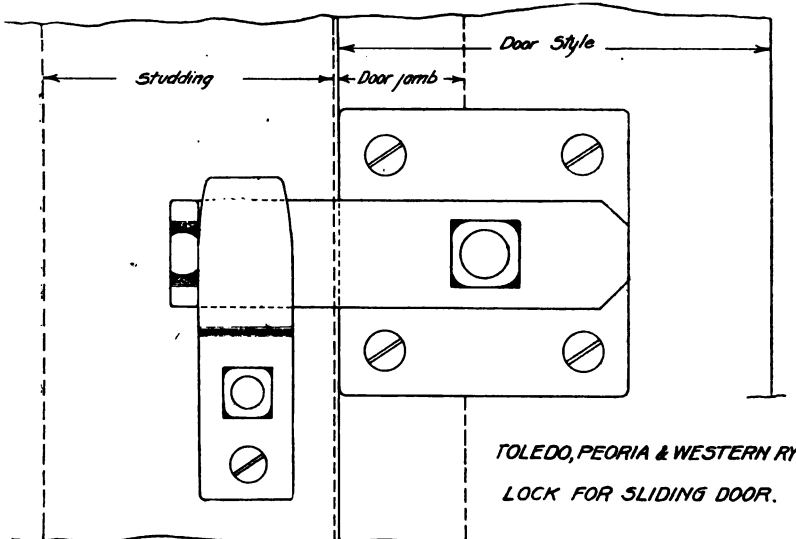
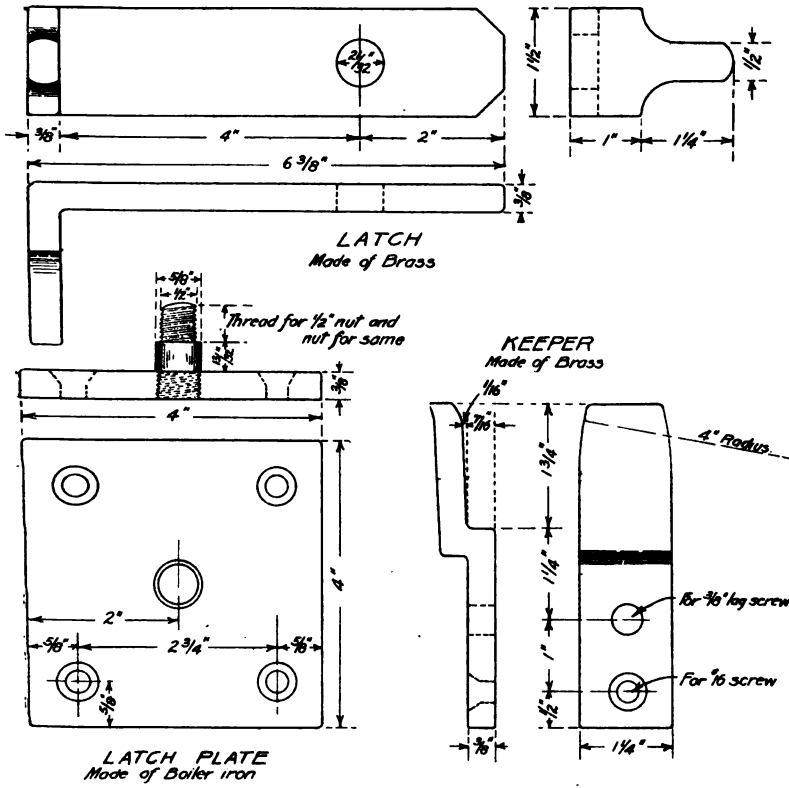
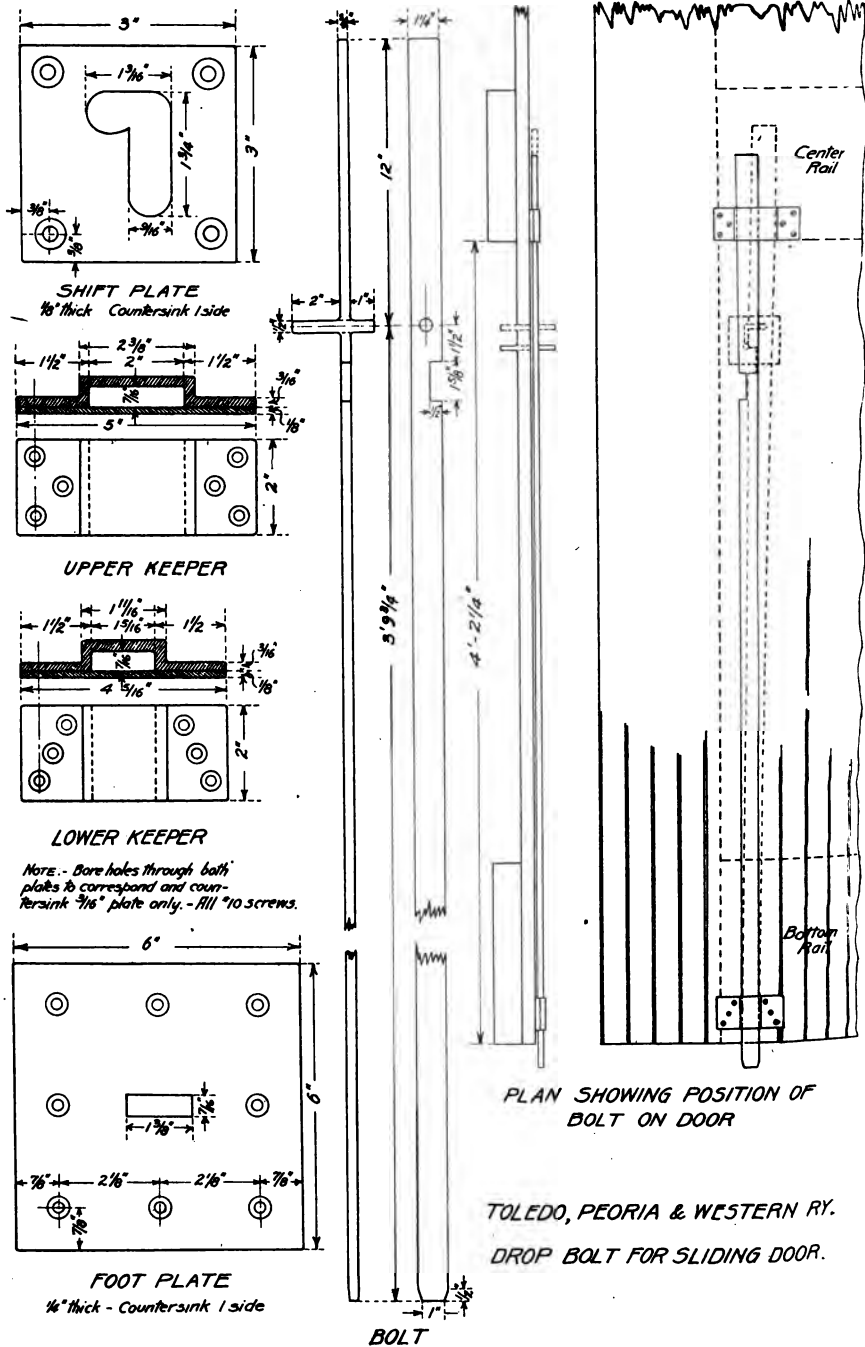


FIG. 40.



there is no use trying to use a good lock on railroad buildings, as no care is taken of them, and a good heavy thumb latch with a cheap strong lock will last as long as any expensive lock, and are the only kind to use in my judgment.

T. C. Burpee, Intercolonial Ry.:

I am sending you blueprint of the only device we have for freight house doors outside of the ordinary fastenings. These cost $4\frac{1}{2}$ to 5 cents per pound, and do the work thoroughly. I would say that there is practically no limit as to their length of service, as there is nothing to break. (See illustration.)

(No Discussion.)

VII.

CONSTRUCTION OF TOWERS AND GUIDES FOR LIGHTS ON DRAWBRIDGES.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your Committee, after sending out a circular letter of inquiry to the representatives of nearly all the railroads represented in our Association, find that 68 per cent. of the roads heard from have no drawbridges. The information received varies a little from the subject itself, and on account of the general information to be derived from these reports, your Committee deems it wise to submit the reports from these gentlemen to the Association, many of which are accompanied by interesting drawings.

Special attention is called to the drawing submitted by our President, J. H. Markley.

EXTRACT FROM CIRCULAR LETTER OF INQUIRY.

Your Committee on subject number seven, "Construction of Towers and Guides for Lights on Drawbridges," would respectfully ask your assistance in getting up an intelligent report to be submitted to our Association at their meeting to be held in Milwaukee, October 15, 1907.

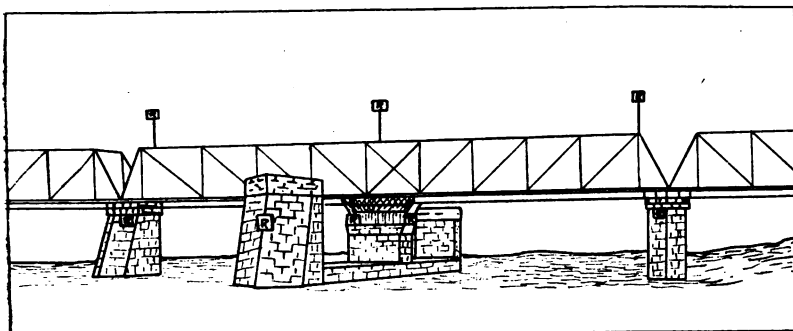
1. What do you use in the way of a tower for placing lights on drawbridges, how constructed and where located on bridge?
2. What method do you use for holding light in proper position in the tower?
3. What kind of lights do you use, how constructed and operated?

The Committee kindly asks that you submit any blueprints or drawings you may have bearing on this subject and any information you may be able to give.

EXTRACTS FROM LETTERS RECEIVED IN ANSWER TO CIRCULAR LETTER OF INQUIRY.

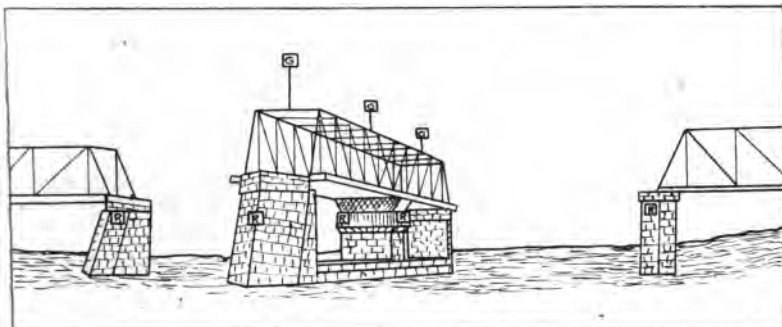
G. W. Rear, General Bridge Inspector, Southern Pacific Co., San Francisco, Cal.:

I send you a blueprint showing the towers used by the Southern Pacific Co., which explains itself. We do not use screwpipe connections, but make them with cast-iron plugs, eyes, etc., with a



LOW BRIDGE WITH SWING DRAW
SHUT

R = Red Light
G = Green Light



LOW BRIDGE WITH SWING DRAW
OPEN

FIG. 42.—So. Pacific System of Lights for Drawbridges.

rivet through pipe and casting. This makes a more satisfactory coupling, as it does not corrode and break off.

I also send a photo showing the towers as applied to one of our bridges and a sketch showing the lighthouse board's requirements, with the regulations governing the same. In operating the lights, they are raised and lowered by a small wire cable running over the pulleys shown. This makes a very satisfactory arrangement.

E. E. Wilson, Supervisor Bridges and Buildings, N. Y. C. & H. R. R. R., New York City:

I enclose you herewith a print showing the location of lights as required by the government for bridges over navigable waters

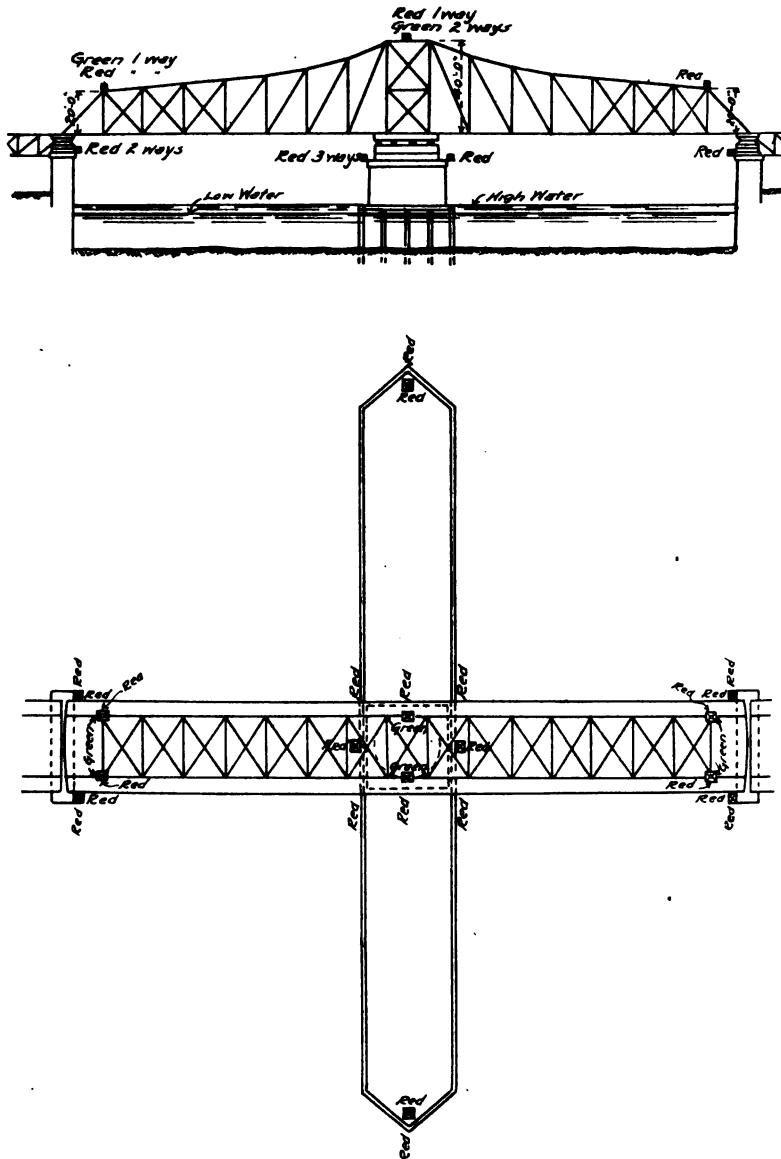


FIG. 43.—N. Y. C. & H. R. R. R. System of Lights for Drawbridges.

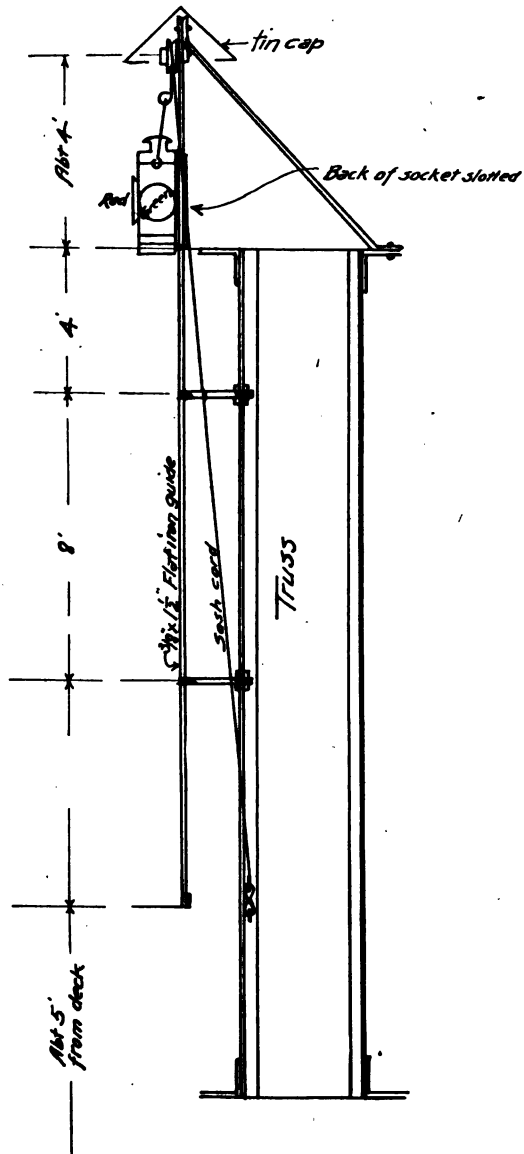


FIG. 44.—Method of Raising Lights N. Y. C. & H. R. R. R. Drawbridges.

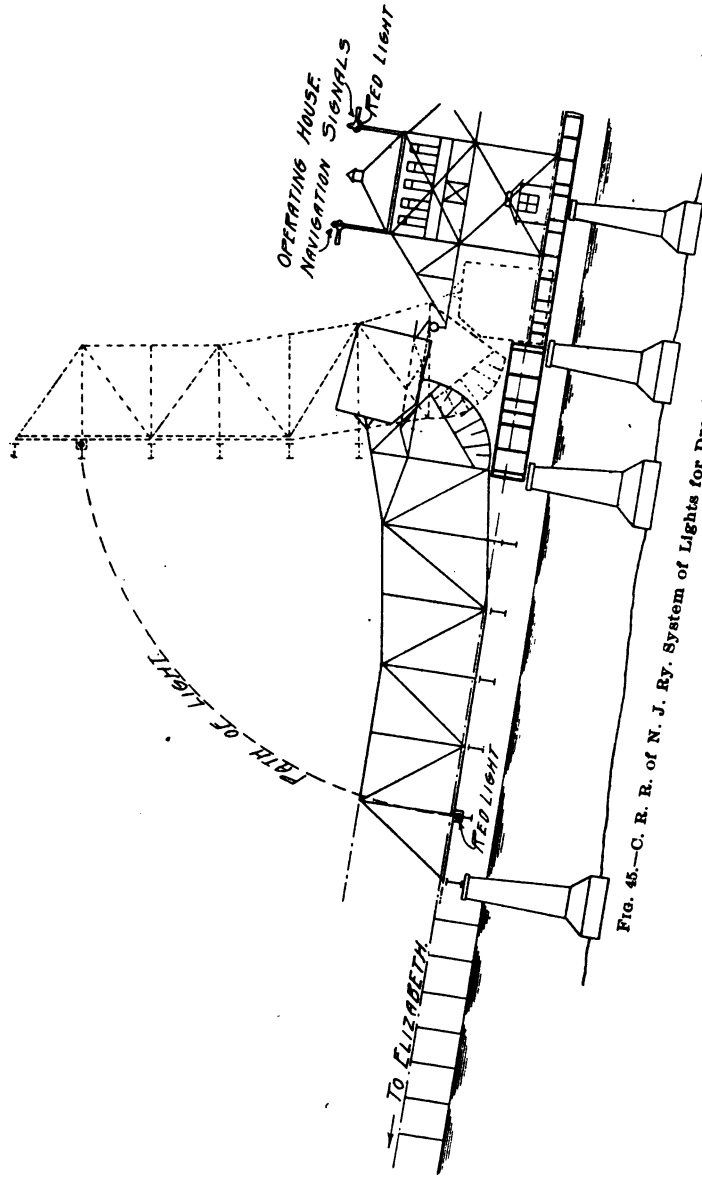


FIG. 45.—C. R. R. of N. J. Ry. System of Lights for Drawbridges.

in New York City. There are fourteen lights required on each bridge, six of which are above the top chord.

I also enclose you a sketch, showing the method we have in use for raising and lowering these top lights. This arrangement has been satisfactory since these lights were installed. The other eight are located, six on the masonry below the bridge and one on each end of the fender. In regard to the questions asked in your circular:

1. A guide bar; see print and sketch.
2. By means of a pulley and cord.
3. Dressell's standard T-23, 5-inch lens semaphore lamp, with a blank lens where we do not want the light to show, operated by cord and pulley from the deck.

A. L. Bowman, Civil and Consulting Engineer, C. R. R. Co. of N. J., New York City:

1. The C. R. R. Co. of N. J. does not use any towers for placing lights on drawbridges.

2. In truss drawbridges the lights are set on top of operating house. In plate girder drawbridges the lights are fastened to the main girders. The channel lights are placed on ends of the channel fenders.

3. We use all Fresnel lens lamps on our Newark Bay lift bridge, where the approach channels are very wide. Generally on our other drawbridges we use ordinary bull's-eye lenses.

I enclose a print of our drawing 3257-48, which shows the special arrangement of channel and navigation lights used at our Newark Bay lift bridge.

J. H. Markley, T. P. & W. Ry., Peoria, Ill.:

As to the tower, I don't think there is much to say, as the print fully explains itself. The one great advantage that I claim for them over anything else is, you need no guide for the lamps until the bottom of the tower is reached; at that point the bale of the cage which the lamp sets in enters what is called the guide head and is then raised to the top of the tower. It matters not how much the lamp swings or in what direction, it cannot enter the guide head but one way, and that is the right way.

I might add that there is no climbing whatever to do; the operator stands on the deck of the bridge and with a one-half inch rope that passes over a pulley at the top of the tower, raises everything into its right and safe position. Blueprint enclosed herewith.

A. E. Killam, Inspector of Bridges and Buildings, Intercolonial Ry. Co., Moncton, N. B.:

There is only one drawbridge on main line of Intercolonial, which is at the Grand Narrows, Cape Briton. This draw stands open all the time during navigation of the Bros de Orr lakes, only being closed ten minutes before the arrival of trains.

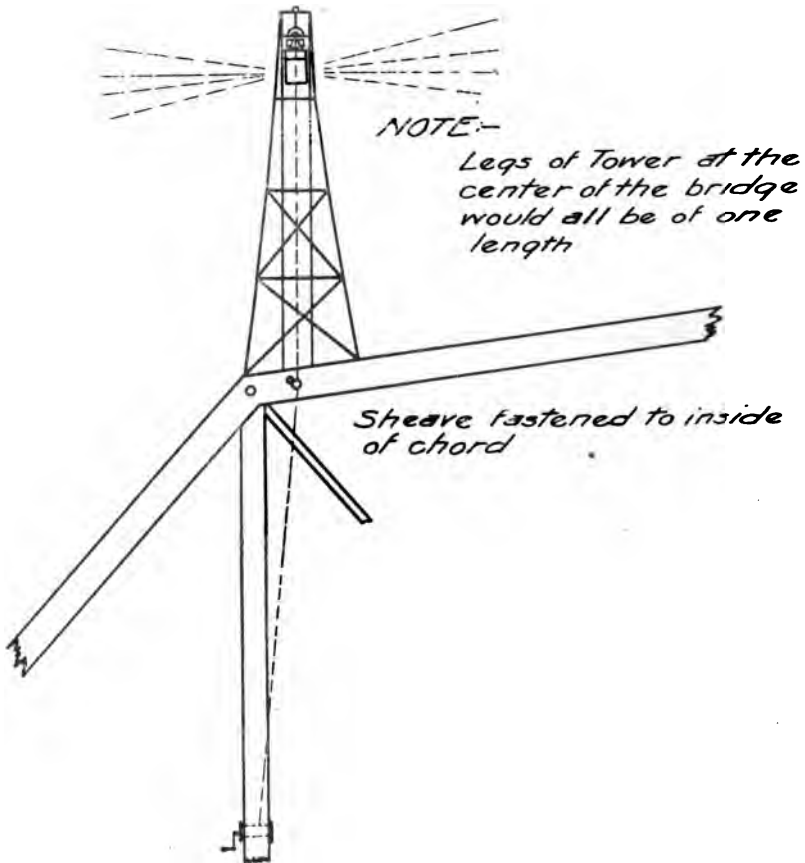


FIG. 46.—J. H. Markley's System of Hanging Light at Drawbridge.

We use red and white lights set in sockets secured to the top of the draw stay frame, 25 feet high; large lamp (oil light), so that approaching trains or vessels can tell the position of the draw.

F. E. Schall, Bridge Engineer, Lehigh Valley Railroad, South Bethlehem, Pa.:

1. We have no special towers for lights on drawbridges. Our bridges are through truss bridges with operating house above clearance line overhead, and the signal lights are placed in this elevated operator's house.

2. The lights are fixed, fastened to the operator's house, the bridge being turned 90 degrees when opened.

3. The lights are the regular signal lamps similar to those used as markers on trains; they need not be operated. The distance and home signals on the approach to the drawbridge are operated automatically by electricity.

T. B. Scheetz, Supt. of Bridges, Missouri Pacific Ry., St. Louis, Mo.:

1. (a) We use towers made from light angle iron, generally using material from scrap bridges, constructing towers as shown on prints attached.

(b) Towers are located on each end and in the center of the draw span. The center tower is also used for carrying the telegraph wires, as shown on blueprint attached.

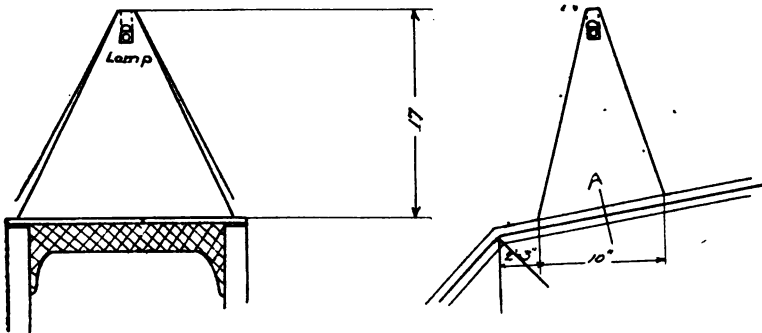


Fig. 6.—Mo. Pac. R. R. System of Lights for Drawbridges.

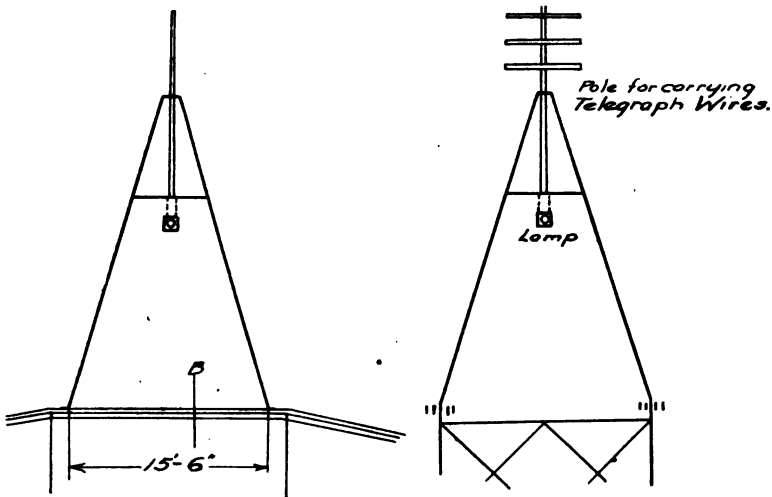


Fig. 47.—Mo. Pac. R. R. System of Lights for Drawbridges.

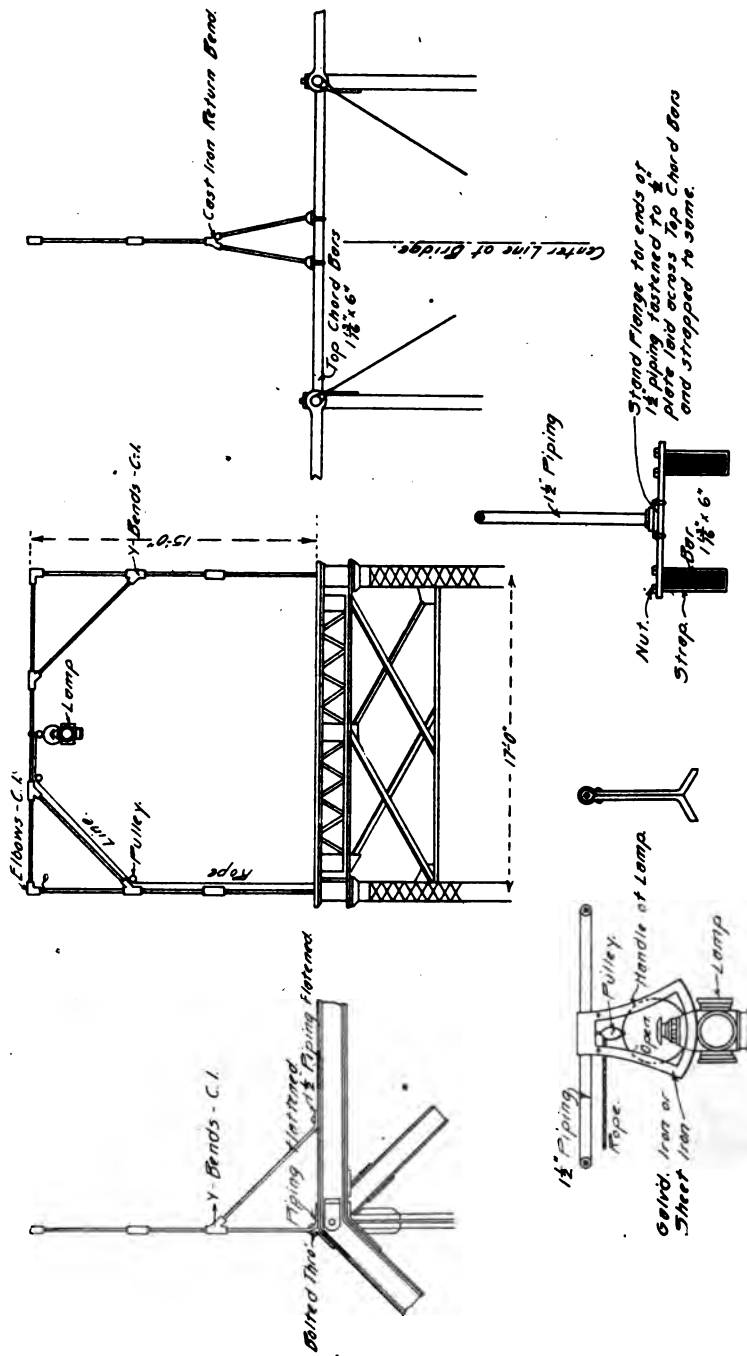


FIG. 48.—Design for Lamp Stands, Sacramento River Bridge, Tanaha, So. Pac. Co.

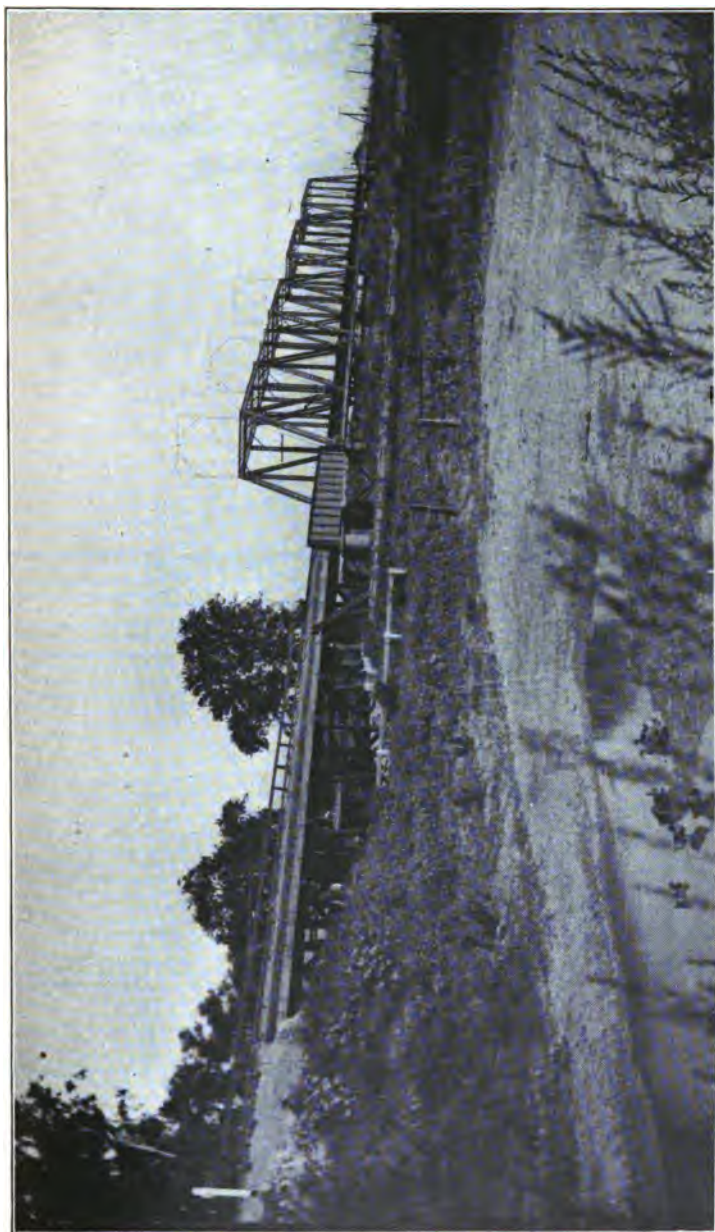
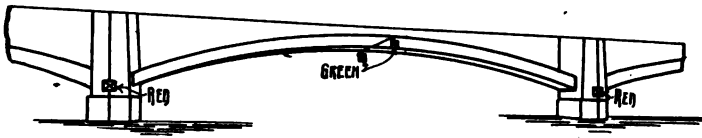
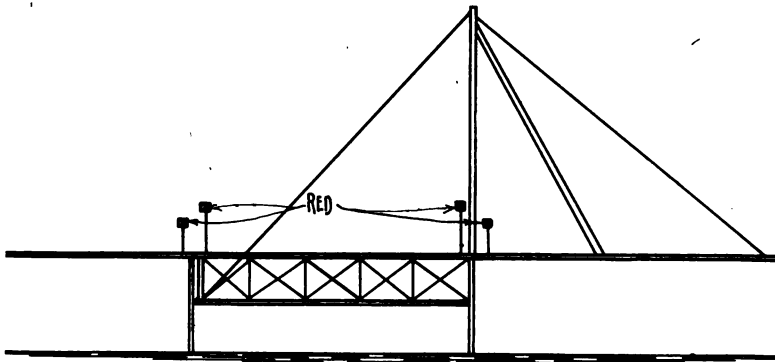


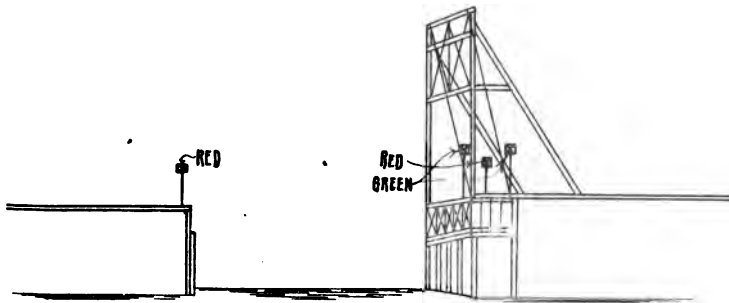
FIG. 48 $\frac{1}{2}$.—Bridge on the Southern Pacific Co. Road.
(By G. W. Rear.)



HIGH TRUSS BRIDGE WITHOUT DRAW



JACK-KNIFE DRAWBRIDGE SHUT



OPEN

FIG. 49.—N. Y., N. H. & H. R. R. Draw Bridge Lights.

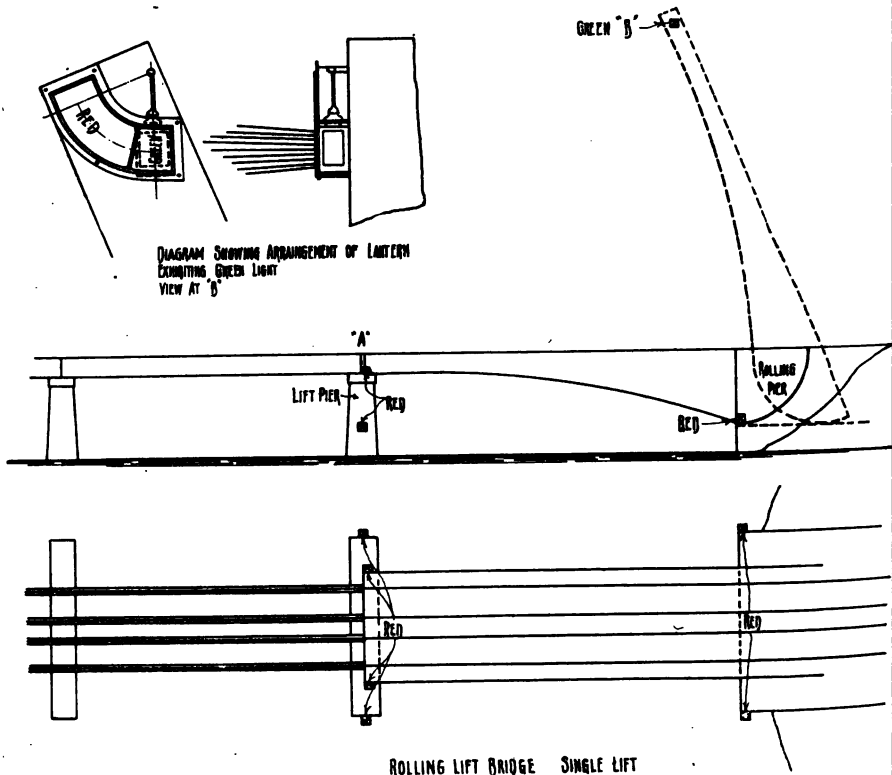


FIG. 50.—N. Y., N. H. & H.R. R. Draw Bridge Lights.

2. Two pulleys are located at the top of tower, over which there is a rope fastened to each side of the lamp for elevating it and holding in correct position.

3. We used the Adams & Westlake lamp, as shown on prints attached.

(a) For all pier lights, a red, 180-degree ($\frac{1}{2}$ -round) 8-inch diameter, Fresnal lens light.

(b) For lights to mark the end of sheer booms, or isolated obstructions, a red, 360-degree (full round) 8-inch diameter, Fresnal lens lamp.

(c) For top lights on draw span, a white, 360-degree (full round), 8-inch diameter, Fresnal lens lamp surrounded by a square frame-work, in which are set red and green roundels, causing the light to show red two ways and green two ways. Lamps made to burn oil. Blueprints showing details enclosed herewith.

J. N. PENWELL, *Chairman*.
FLOYD INGRAM,
GEORGE W. REAR,
G. J. KLUMPP.

REGULATIONS FOR LIGHTING BRIDGES OVER NAVI- GABLE RIVERS.

ADOPTED BY THE LIGHTHOUSE BOARD, IN ACCORDANCE WITH THE ACT
OF CONGRESS, APPROVED AUGUST 7, 1882.

LOW BRIDGES WITH SWING DRAWS.

Every low bridge with a double draw shall have a *red* light on each end of the draw-piers. Each protection pier (whether placed in front of a pivot or draw-pier) shall have a *red* light at each free end placed as low as practicable. Each pivot pier shall have one *red* light on each side where the pier is crossed by the axis of the bridge, and placed below the floor level of the same.

In order to make it distinct whether the draw is open or closed, there shall be placed three square lanterns on top of the draw-span, all of them raised fifteen feet above the top of the draw. These lanterns are to show *green* along the axis of the draw, and red at right angles to the axis. The result will be that when the draw is shut there will be shown up and down the stream three high *red* lights above the permanent low lights; when open, three *green* lights will be seen in line, up and down the stream, with the low permanent red light showing the width of the openings.

All of these lights shall be permanent.

DISCUSSION.

Mr. Penwell.—In regard to subject number seven, as I told the president at the time I was placed on this committee, it is something that I knew but little about, as I have never had any experience with draw bridges. And we may

not have gotten out of this subject what we should have; but we have made a report and respectfully submit it for what it is worth. I have received some blue prints since coming to the convention, which will no doubt be embodied in our report and I wish to call your attention to all of them, and if any of the members are interested in this subject they can look them over and I will then give them to the secretary. On one of these prints I wish to call your attention to the sliding guide over the lights. Something similar to that which we saw on our trip last night on the fire boat with the mayor, a very simple device changing from red to green lights, and it strikes me as being something worthy of notice. Among these blue prints is one from the Lake Shore and Michigan Southern Ry. of a proposed plan, which has not been put in use yet. Would like to submit these various prints to our worthy secretary, as I think they should be embodied in our proceedings. Our president has, I believe, the most complete guide for a draw bridge light that I have yet examined, and while the others are good, his plan for the guide makes it absolutely sure that the lamps will be raised and lowered properly. It is a simple device and the man who is operating the lights does not have to do any climbing and I think it is a very excellent plan.

Mr. A. S. Markley.—In passing up and down the river on the fire boat last night with the mayor, I noticed the lights on the lift bridges. The cover hung on a pivot and as the bridge went up it exposed the green light automatically, and as the bridge came down the green light would turn and show red. It certainly makes a very good lighting arrangement for that kind of a bridge and service.

Mr. Penwell.—That is the light as explained in the New York, New Haven & Hartford blue print, which gives an exact idea of the plan.

Mr. Reid.—All draw bridge lights are specified by the government, that is, the size of the lantern, etc., as well as

the color. The government issues a book called rules of the lighthouse board for lighting channels. This book shows the various methods for lighting low bridges, swing bridges, etc. There are six or eight different methods for lighting the different classes of bridges. The information given is very complete and any one can obtain it upon application to the government.

Mr. A. S. Markley.—The chairman has just handed me the blue print of the New York, New Haven & Hartford, and it very plainly brings out the operation of the lamp that I referred to in going up the river last night. The print as I understand it was not received until this morning and therefore came too late to be embodied in the report of the committee.

President.—These lights are governed by the U. S. government engineer, or what is called the Light House Board. They usually make an inspection once each year. In the past year we have put new lights on our drawbridge—such as they specify—at a cost of \$15 each. They specify, too, the position of the lights, the height, etc. The point that we are trying to determine is the manner of getting the lights up to their height, and in the right position.

Mr. Penwell.—For the information of this association, I will say that I was somewhat surprised to know how few railroads have to contend with draw bridges. From the letters we received, fully 68 per cent. of the railroads heard from have no draw bridges on their system. I had a letter from one member from whom I thought I would be able to get some valuable information in regard to the method in his country, but he stated that he had none.

President.—Anything more to be said on this subject? If not we will close this discussion and take up subject number eight.

VIII.

RECENT EXPERIMENTS IN PROTECTING STEEL RAILROAD BRIDGE AGAINST THE ACTION OF BRINE FROM REFRIGERATOR CARS.

REPORT OF COMMITTEE.

To the Association of Railway Superintendents of Bridges and Buildings:

Your committee on subject number eight begs to submit the following report:

The committee is agreed upon two features of the problem, viz: That the proper remedy for the trouble is in so constructing the cars that the brine can be retained till some station is reached where it can be drawn off by the train hands without injury to structures; and that no paint has been found that is effective in protecting the metal.

Mr. Berg reports: "The Lehigh Valley Railroad has not adopted any special construction methods for the protection of bridges against the action of salt brine from refrigerator cars, except the ordinary protection of the steel work by paint.

"We have found no satisfactory paint thus far to withstand this action for any length of time, so that certain parts of the bridges, depending upon local conditions and class of construction, have to be painted every year."

Mr. Montzheimer says: "I know of practically nothing that has been done by railways with a view of protecting bridge floors from salt water brine, with the exception that most of the track elevation bridges are covered with asphalt or some other waterproofing compounds, which has a tendency to protect the bridge floor from the brine; at the same time this waterproofing is not done so much to protect the bridges from the salt brine as it is to make the bridges water-tight.

"It seems to me the best way to obviate this trouble is to have the drips from the refrigerator cars piped to the center of the track and then protect our bridges so that water dripping on the center of the track will not go to the steel work."

Mr. Draper sends a sketch of a protection that is proposed to be tried on his road (see fig. 1), saying: "I am sending you a print showing the proposed method of protecting our floor system from salt water and also from the weather in general. You will note it is a galvanized iron box trough used as a spacing block between the ties, and made with a pitch in order to turn the water off very rapidly. This protects our floor system from the rust from the rails, which is as bad as salt brine in destroying the paint.

"We have used on this road all classes of paint, but have not

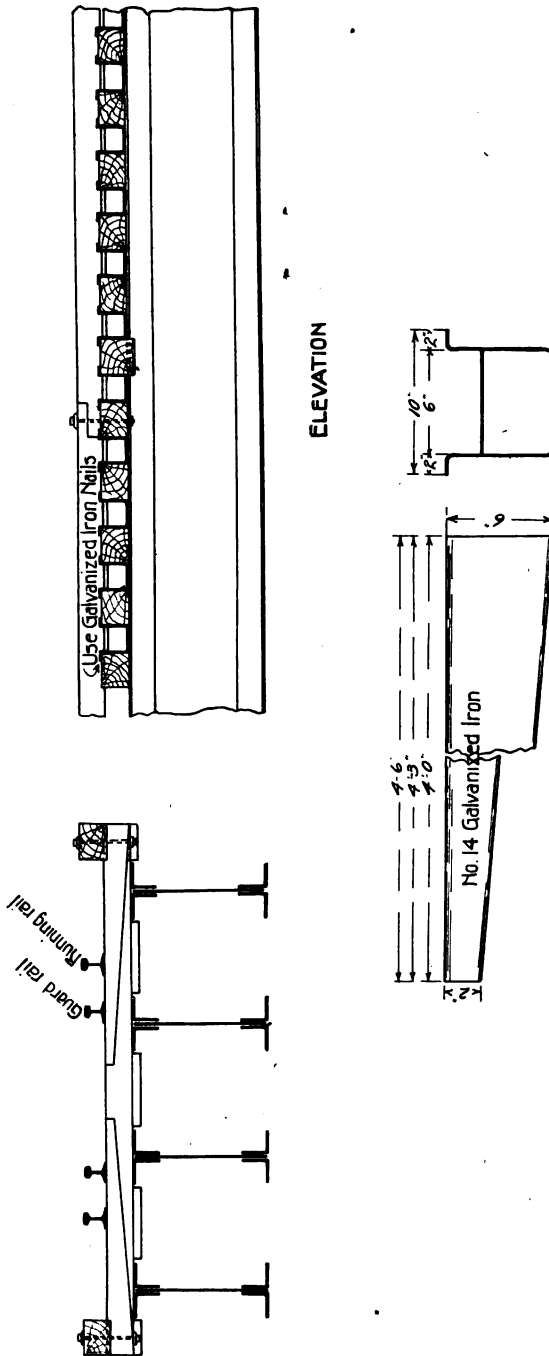


FIG. 51.—I. C. R. B. Proposed Method of Protecting Floors of Iron Bridges from Brine and Water.

found anything that will overcome salt water, and I think that in the future we will have to resort to this method of covering to keep off the dirt, rust and salt water from the steel.

"Our estimated cost of putting on an ordinary deck on a steel structure is \$4.50 per foot for labor and material. This method of covering will add an additional cost of \$1.65 per foot, making a total of \$6.15 per running foot; and I am satisfied that we will receive better results by keeping our steel work properly covered with paint. This, you will note on the plan, is to be used for deck plate girders, through plate girders and through truss spans. The girders and spans where we have the corrugated floor system and use a 6 x 8 yellow pine tie, should be covered on the outside of the rail with 1 1/2" matched lumber. This will overcome the drip from falling direct on to the steel."

Mr. Carr states that he has charge only of buildings and hence has no information on the subject.

Your chairman wishes to recommend that all equipment which scatters salt brine along the line of tracks be provided with a copper tank on each car with sufficient capacity to hold all the salt brine that may be made from melting ice, and have it emptied at destination of car, or at points where such car is re-iced. The practice of scattering salt-brine should be stopped; and it can be stopped much cheaper and with better results than for us to try to protect our structures from such action, which we are sure to fail in.

In 1898, at the Richmond meeting, a report was made on this subject in which it was estimated that one refrigerator car would produce about 200 gallons of brine in twenty-four hours. The suggestion was made that the cars be piped so that the brine shall be discharged at center of track and the structures provided with troughs to carry it clear of the metalwork.

In the discussion of this report tanks were suggested and a method of filling between the ties with blocks bedded in paint somewhat similar in principle to Mr. Draper's scheme. President Berg stated that the Master Car Builders' Association had considered this matter and a committee had submitted two schemes, one of which, consisting of piping to center of track and discharging through a hose reaching nearly to the ground (see fig. 2) was adopted by the association as "Recommended Practice."

At the Quebec meeting, in 1903, the subject was discussed. In the report Mr. Benjamin Douglas of the Michigan Central described his method of applying asphalt to floor plates by heating the iron and pouring on hot asphalt. This formed a sort of enamel, the asphalt adhering to the iron perfectly. A modification of this method could be applied to ordinary floors affected by brine drippings.

It was also suggested at this meeting that tops of stringers and floor beams be covered with ready roofing or similar material as a protection from brine. Several members promised to try it and report at future meetings. It is hoped that the experience gained will be brought out at our meeting this year.

At the Pittsburg meeting, in 1905, the subject was again reported upon and discussed. Mr. Reid of the Lake Shore and Mr. Cartlidge of the Chicago, Burlington & Quincy reported on the use of roofing felt on stringers; the latter finding it satisfactory

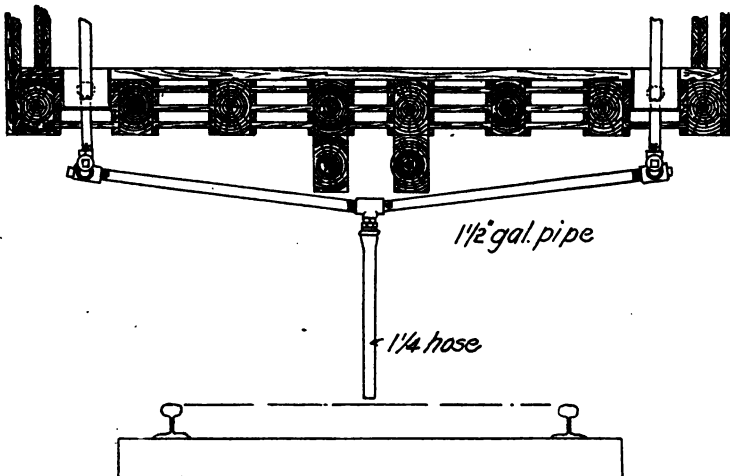
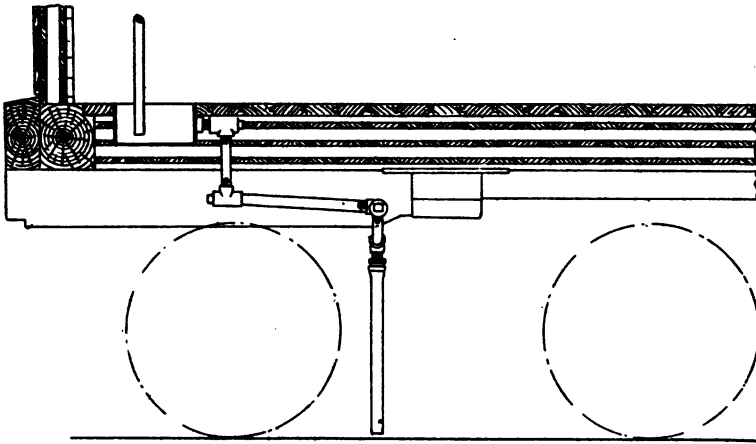


FIG. 52.—Device for Disposing of Salt-Water Drippings.

and the former stating that it soon cut through. Mr. Loweth of the Chicago, Milwaukee & St. Paul stated that he was trying "iron bark," a material made by Edward Smith & Co., being canvas ducking saturated in a preparation of linnoxyn and a resinous flux. A recent letter, August 27 last, from Mr. Loweth, states that on several spans of deck girders with creosoted timbers laid close and covered with ballast, the iron bark placed over the girder flanges under timber was in perfect condition after two years' wear. On several standard floor bridges with 4-inch spaces between ties, the iron bark had cut through under the ties or crimped up between them. The material and its application is expensive and except in the case of solid continuous timbering does not seem to be entirely satisfactory. It is the material used for covering the cables of the Williamsburg bridge at New York.

This subject interests signal officers and track-men and their coöperation is earnestly desired in finding the best solution of the problem.

R. P. MILLS, *Chairman*,
A. MONTZHEIMER,
WALTER G. BERG,
F. O. DRAPER,
CHARLES CARR,
Committee.

DISCUSSION.

President.—Has anyone anything to say on the eighth subject? Of course, this subject will come up again at the next meeting.

Secretary.—Mr. President, I will say that I have a written discussion here that I would like to have read, which we received from Mr. J. P. Snow, whom all of you know very well.

President.—The assistant secretary will please read the written discussion from Mr. J. P. Snow on refrigerator cars with reference to reservoirs to collect the brine to be discharged at division points.

DISCUSSION OF REPORT OF COMMITTEE NUMBER EIGHT.

By J. P. Snow.—In connection with the scheme of providing refrigerator cars with reservoirs to collect brine so that it may be discharged at division points, which seems such a logical solution of the problem and is so popular with bridge men who discuss the matter, it is significant to review the words of the master car builders' committee and their report of 1898, referred to by Mr. Berg at our

Richmond meeting and mentioned in the report before us. They there say:

"Ever since this subject was first brought to public attention in 1896, there has been an effort on the part of the owners of the refrigerator cars in which dressed beef is handled to create the impression that salt water drippings were not doing any particular harm, and might be neglected." * * *

"The committee started out with the idea of having refrigerator cars fitted with one or more reservoirs, to be attached underneath the car body, into which the salt water drippings could be conveyed, the reservoirs to be large enough so that they would not have to be emptied more than once every twelve hours, at division terminals, where proper provision could be made for taking care of the salt water. This idea, however, met with so much opposition on the part of the refrigerator car owners that the committee abandoned it, not caring to recommend an arrangement that the refrigerator car owners would be unwilling to adopt."

This is the crux of the matter as far as reservoirs go. No puny efforts on the part of our association, nor of the more influential Master Car Builders' Association, nor of state legislatures, can bring about any action on the part of the autocratic owners of private cars. The yellow beef cars are the privileged knights of the road. Nothing short of national regulation will bring their owner's attention down to so small a matter as saving bridge men trouble in caring for their structures.

It may not be impossible for us to invoke government aid if we can make it appear that the scattering of brine is prejudicial to health or liable to spread the germs of disease. Many roads are up against the problem of providing reservoirs for toilet closets on their trains, and the maintenance and emptying of these will surely be a much more difficult proposition than caring for brine reservoirs on beef cars. The two improvements should be considered together.

In the meantime bridge men must protect their structures as best they can. Any good paint will last a while. None will last forever. As to methods: Yearly or more frequent patching is probably the best and cheapest. Ballast on concrete decks, properly waterproofed, is probably the most permanent, and is, at present, winning favor for substantial merits in other directions than protecting steel work from rusting. Where abrasion is not present, the life of a coating will depend on the quality of the paint, the clearness of the surface and the dryness of the iron when the paint is applied. We must remember that the surface of cold iron always has moisture entangled in its roughnesses. Many kinds of paint simply imprison this moisture, and it helps to rust the iron and throw off the paint. If the iron is heated as described by Mr. Douglass in the 1903 report, this moisture is driven off and one great enemy to the durability of paint vanquished. If a paint is used that absorbs moisture, the same object is accomplished. For portions of a bridge subjected to serious damage by brine, expensive paints are surely more economical than cheap ones, if more durable. The resinous flux, which is a kind of varnish, spoken of by Mr. Loweth in connection with iron bark and marine tocolith, the pigment of which is Portland cement, are two paints of this class. They adhere very well to the iron and can be applied in heavy coats. Canvas is used with both these materials but in my opinion the paint alone if put on heavy enough will give the best results.

Mr. A. S. Markley.—The solution suggested of using concrete decks is one which has already been proposed, but that does not altogether solve the problem. Nothing short of the accumulation of the brine and depositing it somewhere along the line where it will not destroy the structure will be satisfactory. The injury to the rails we have also lost sight of, as brine will destroy the rails as well as the bridges.

Mr. Schall.—The brine drippings from refrigerator cars are what cause the trouble on the Lehigh Valley Railroad.

Steel bridges may be painted every six months, and it does not matter what kind of paint is used, it will be eaten away by the brine drippings.

On our line whole trains of refrigerator cars are hauled, and, on account of the brine drippings, it is impossible to preserve the metal as it should be with any kind of paint. The heads of rivets are eaten away slowly and the roads that do not haul refrigerator cars have no idea of the trouble caused by these brine drippings.

This is a question which must be faced squarely; something must be done to overcome this difficulty either by providing suitable reservoirs on the cars to receive the brine, to be tapped at certain fixed points, or else we will have to find some protective agent to withstand the effects of the brine, or build solid floor concrete bridges.

Mr. A. S. Markley.—Mr. President, Mr. Schall is correct about the salt brine nuisance, and something should be done, either in the way of having reservoirs in the car to store this brine and to dump it at terminal stations, where there is no danger, or where there is a full train of meat passing over the road, a tank car should be attached to the rear end and the brine pumped out into this tank car and then have it dropped when full, tank or car sufficiently large to hold the brine until destination is reached. Or another method would be to cover your iron or to build ballast decks.

Mr. Hubbard.—There is only one way to protect iron and that is to paint it and keep it painted.

Mr. Reid.—In addition to the paints, which can be used for protecting steel, there are several other preparations similar to asphalt or tar, and other patent compositions that are very good, if properly applied to the metal. Some of this was put on the steel floors of our elevated bridges in Chicago and then gravel placed on top of that, and when we had occasion to remove this composition from the floors, we found it to be quite an undertaking, and where it was taken off the floors were as bright as when they came out

of the mill. I think that it would undoubtedly protect the metal indefinitely and be good for fifty years if properly applied.

A. S. Markley.—In reference to Mr. Reid's remark in regard to solid decks, I cannot see why a preparation of gravel roofing would not apply as well as anything. The gravel roof on our Twelfth Street freight house in Chicago was put on in 1890, and has been on now seventeen years and has been recoated only twice, once about three years ago and once previous to that. Last summer the company put a concrete subway over street. We applied this same roofing to that on top of concrete deck, first cleaning thoroughly before putting on this preparation. We put four ply felt well mopped with hot preparation of roofing pitch prepared between the laps of paper and after all felt was on one coat of prepared pitch over paper was applied; on top of that we put two inches of fine sand and six inches of gravel ballast. So far there has been no water through it and it is doing very nicely.

Mr. W. O. Eggleston.—I have thought a good many times that it would be a good policy for this association to request the master car builders' association to provide some way to handle this salt water from those refrigerator cars and to distribute it in the yards or some place on the lines and not over our bridges. It seems to me that it is a matter that is up to them to take care of their own products in these cars. It is a matter of putting drip pans or tanks underneath the cars to catch these drippings until they reach a terminal, where the car inspectors can open these tanks of salt water as they look over the train. I think this matter could be handled and that it is a matter that should be handled. And it means thousands of dollars to the railroad companies handling meat products over their lines.

Mr. Killam.—This painting question or preservatives is certainly a very important one. We have a very large number of bridges to protect and the climatic conditions are

so different that paint put on in one place will not last half as long as in another locality. Our bridge painting is nearly all done by contract and paid for by the yard, and in the specifications it is provided that it shall be either Leach & Neals of Derby, England, or Walter Carson's Anti-Corrosion. I know of some bridges painted with Walter Carson's Anti-Corrosion paint, where the paint has lasted for seventeen years, but on another part of the road in five years it would be in very much worse condition.

President.—Anything further on this subject? If not we will close it.

LIST OF ANNUAL CONVENTIONS.

First,	St. Louis, Mo.,	September 25, 1891.
Second,	Cincinnati, Ohio,	October 18, 19, 1892.
Third,	Philadelphia, Pa.,	October 17 to 19, 1893.
Fourth,	Kansas City, Mo.,	October 16 to 18, 1894.
Fifth,	New Orleans, La.,	October 15, 16, 1895.
Sixth,	Chicago, Ill.,	October 20 to 22, 1896.
Seventh,	Denver, Col.,	October 19 to 21, 1897.
Eighth,	Richmond, Va.,	October 18, 19, 1898.
Ninth,	Detroit, Mich.,	October 17, 18, 1899.
Tenth,	St. Louis, Mo.,	October 16 to 18, 1900.
Eleventh,	Atlanta, Ga.,	October 15 to 17, 1901.
Twelfth,	Minneapolis, Minn.,	October 21 to 23, 1902.
Thirteenth,	Quebec, Canada,	October 20 to 22, 1903.
Fourteenth,	Chicago, Ill.,	October 18 to 20, 1904.
Fifteenth,	Pittsburg, Pa.,	October 17 to 19, 1905.
Sixteenth,	Boston, Mass.,	October 16 to 18, 1906.
Seventeenth,	Milwaukee, Wis.,	October 15 to 17, 1907.

MEMBERSHIP.

Year 1891-2.	.	.	.	Number of active members, 60.
Year 1892-3.	.	.	.	Number of active members, 112.
Year 1893-4.	.	.	.	Number of active members, 128.
Year 1894-5.	.	.	.	Number of active members, 115.
Year 1895-6.	.	.	.	Number of active members, 122.
Year 1896-7.	.	.	.	Number of active members, 140.
Year 1897-8.	.	.	.	Number of active members, 127.
Year 1898-9.	.	.	.	Number of active members, 148.
Year 1899-1900.	.	.	.	Number of active members, 148.
Year 1900-01.	.	.	.	Number of active members, 143.
Year 1901-02.	.	.	.	Number of active members, 171.
Year 1902-03.	.	.	.	Number of active members, 195.
Year 1903-04.	.	.	.	Number of active members, 223.
Year 1904-05.	.	.	.	Number of active members, 293.
Year 1905-06.	.	.	.	Number of active members, 313.
Year 1906-07.	.	.	.	Number of active members, 340.
Year 1907-08.	.	.	.	Number of active members, 341.

**LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES
AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1906-1907.**

YEAR.	1891-2.	1892-3.	1893-4.	1894-5.
President.....	O. J. Travis.....	H. M. Hall.....	J. E. Wallace.....	Geo. W. Andrews.
First Vice-President....	H. M. Hall.....	J. E. Wallace.....	Geo. W. Andrews..	W. A. McGonagle.
Second Vice-President..	J. B. Mitchell....	G. W. Hinman....	W. A. McGonagle..	L. K. Spafford.
Third Vice-President...	James Stannard..	N. W. Thompson.	L. K. Spafford.....	James Stannard.
Fourth Vice-President...	G. W. Hinman....	C. E. Fuller.....	E. D. Hines.....	Walter G. Berg.
Secretary.....	C. W. Gooch.....	S. F. Patterson ..	S. F. Patterson	S. F. Patterson.
Treasurer.....	George M. Reid..	George M. Reid..	George M. Reid....	George M. Reid.
Executive Members.....	W. R. Damon.....	G. W. Andrews...	Quintine McNab ..	James Stannard.
	G. W. Markley...	Joseph M. Staten.	Aaron S. Markley..	James H. Travis.
	W. A. McGonagle	J. M. Caldwell....	Floyd Ingram.....	Joseph H. Cummin.
	G. W. McGehee...	Quintine McNab..	James Stannard....	R. M. Peck.
	G. W. Turner.....	Floyd Ingram....	James H. Travis ...	J. L. White.
	J. E. Wallace.....	Aaron S. Markley	Joseph H. Cummin	A. Shane.

YEAR.	1895-6.	1896-7.	1897-8.	1898-9.
President.....	W. A. McGonagle..	James Stannard...	Walter G. Berg....	Joseph H. Cummin.
First Vice-President...	L. K. Spafford.....	Walter G. Berg	Joseph H. Cummin	Aaron S. Markley.
Second Vice-President	James Stannard....	Joseph H. Cummin	Aaron S. Markley.	C. C. Mallard.
Third Vice-President..	Walter G. Berg	Aaron S. Markley..	G. W. Hinman.....	Walter A. Rogers.
Fourth Vice-President.	Joseph H. Cummin	R. M. Peck.....	C. C. Mallard	Joseph M. Staten.
Secretary	S. F. Patterson.....	S. F. Patterson	S. F. Patterson	S. F. Patterson.
Treasurer.....	George M. Reid...	N. W. Thompson...	N. W. Thompson..	N. W. Thompson.
Executive Members.	R. M. Peck.....	W. O. Eggleston...	George J. Bishop..	Wm. S. Danes.
	J. L. White	W. M. Noon	C. P. Austin.....	J. H. Markley.
	A. Shane.....	Joseph M. Staten ..	M. Riney.....	W. O. Eggleston.
	Aaron S. Markley..	George J. Bishop...	Wm. S. Danes	R. L. Hefin.
	W. M. Noon	C. P. Austin.....	J. H. Markley	Frank W. Tanner.
	Joseph M. Staten...	M. Riney.....	W. O. Eggleston ..	A. Zimmerman.

**LIST OF OFFICERS OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES
AND BUILDINGS FROM ITS ORGANIZATION TO THE YEAR 1906-1907.**

YEAR.	1899-1900.	1900-1901.	1901-1902.	1902-1903.
President.....	Aaron S. Markley	W. A. Rogers.....	W. S. Danes.....	B. F. Pickering.
First Vice-President...	Walter A. Rogers	W. S. Danes.....	B. F. Pickering.....	C. C. Mallard.
Second Vice-President..	Joseph M. Staten	B. F. Pickering.....	A. Shane.....	A. Shane.
Third Vice-President...	Wm. S. Danes....	A. Shane.....	A. Zimmerman.....	A. Zimmerman.
Fourth Vice-President..	B. F. Pickering...	A. Zimmerman....	C. C. Mallard.....	A. Montzheimer.
Secretary.....	S. F. Patterson...	S. F. Patterson....	S. F. Patterson....	S. F. Patterson.
Treasurer.....	N. W. Thompson.	N. W. Thompson..	N. W. Thompson..	N. W. Thompson.
Executive Members...	T. M. Strain.....	T. M. Strain.....	A. Montzheimer....	W. E. Smith.
	R. L. Heflin.....	H. D. Cleaveland..	W. E. Smith.....	A. W. Merrick.
	F. W. Tanner....	F. W. Tanner.....	A. W. Merrick.....	C. P. Austin.
	A. Zimmerman...	A. Montzheimer....	C. P. Austin.....	C. A. Lichty.
	H. D. Cleaveland	W. E. Smith.....	C. A. Lichty.....	W. O. Eggleston.
	A. Montzheimer..	A. W. Merrick.....	W. O. Eggleston..	J. H. Markley.
YEAR.	1903-1904.	1904-1905.	1905-1906.	1906-1907.
President.....	A. Montzheimer..	C. A. Lichty.....	J. B. Sheldon.....	J. H. Markley.
First Vice-President.....	A. Shane.....	J. B. Sheldon	J. H. Markley.....	R. H. Reid.
Second Vice-President...	C. A. Lichty	J. H. Markley.....	R. H. Reid.....	J. P. Canty.
Third Vice-President.....	J. B. Sheldon.....	R. H. Reid	R. C. Sattley.....	H. Rettinghouse.
Fourth Vice-President...	J. H. Markley	R. C. Sattley.....	J. P. Canty.....	F. E. Schall.
Secretary.....	S. F. Patterson....	S. F. Patterson..	S. F. Patterson....	S. F. Patterson.
Treasurer	C. P. Austin.....	C. P. Austin.....	C. P. Austin.....	C. P. Austin.
Executive Members...	R. H. Reid.....	W. O. Eggleston..	H. Rettinghouse..	W. O. Eggleston.
	W. O. Eggleston..	A. E. Killam.....	A. E. Killam.....	A. E. Killam.
	A. E. Killam.....	H. Rettinghouse..	J. S. Lemond.....	J. S. Lemond.
	R. C. Sattley.....	J. S. Lemond.....	C. W. Richey.....	C. W. Richey.
	H. Rettinghouse.	W. H. Finley.....	H. H. Eggleston..	H. H. Eggleston.
	J. S. Lemond.....	C. W. Richey.....	F. E. Schall.....	B. J. Sweatt.

YEAR.	1907-1908.	1908-1909.	1909-1910.	1910-1911.
President.....	R. H. Reid.....			
First Vice-President....	J. P. Canty.....			
Second Vice-President..	H. Rettinghouse.			
Third Vice-President....	F. E. Schall.....			
Fourth Vice-President..	W. O. Eggleston.			
Secretary.....	S. F. Patterson...			
Treasurer.....	C. P. Austin.....			
Executive Members...	A. E. Killam.....			
	J. S. Lemond.....			
	C. W. Richey.....			
	Thomas S. Leake			
	W. H. Finley.....			
	J. N. Penwell.....			

SUBJECTS FOR REPORT AND DISCUSSION, AND COMMITTEES SELECTED AT EACH CONVENTION SINCE ORGANIZATION OF THE ASSOCIATION IN 1891.

FIRST CONVENTION, ST. LOUIS, MO., SEPTEMBER 25, 1891.

Subjects.	1.	Committees.
Surface Cattle-Guards.....		{ Aaron S. Markley, J. B. Mitchell, W. R. Damon.
	2.	
Frame and Pile Trestles Complete, including Rerailer		{ H. M. Hall, W. A. McGonagle, G. W. McGehee.
	3.	
Framing and Protection of Howe Truss and Other Wooden Bridges against Fire and Decay.....		{ J. E. Johnson, G. W. Markley, J. H. Markley.
	4.	
Iron and Vitrified Pipe for Waterways under Rail- road Embankments.....		{ James Stannard, J. O. Thorn, J. E. Wallace.
	5.	
Water-Tanks Complete, including Painting, Pumps, Pump and Coal Houses, Wells and Reservoirs		{ G. W. Turner, R. K. Ross, Q. McNab.
	6.	
Interlocking Signals.....		{ B. F. Bond, G. W. Hinman, James Demars.
	7.	
Depot Platforms, Complete.....		{ J. A. Nicholson, Adam McNab, C. B. Keller.
	8.	
Paints for Iron Structures.....		{ Geo. M. Reid, A. J. Kelley, H. A. Hanson.

SECOND CONVENTION, CINCINNATI, O., OCTOBER 18 AND 19, 1892.

	1.	
Discipline, and Benefits Derived, and Who are the Beneficiaries.....		{ Geo. W. Andrews, W. R. Damon, T. M. Strain, G. W. Turner.
	2.	
Turn-table, Best, with a View of Economy, and Dura- bility, and Strength		{ G. W. Markley, H. F. Martin, James H. Travia, Charles Walker.
	3.	
Water Columns, Best, Cheapest, Simplest, and Most Durable		{ C. E. Fuller, A. S. Markley, H. N. Spaulding, E. L. Cary.
	4.	
Coaling Stations, including Storage Bins and for Coaling Engines.....		{ J. E. Wallace, C. W. Gooch, G. W. Hinman, J. H. Cummin.

5.
Crawling of Rails, and its Effects on Structures..... { Geo. M. Reid,
L. K. Spafford,
J. B. Mitchell,
L. S. Isdell.
6.
Guard-Rails on Bridges, Advantages and Disadvan-
tages, and Best to be Adopted..... { O. J. Travis,
Q. McNab,
J. F. Mock,
J. M. Staten.
7.
Platforms, Height and Distance from Rail and Mode
of Construction..... { James Stannard,
M. Walsh,
N. M. Markley,
Robert Ogle.
8.
Best Bridge, Wood, Combination, or Iron, from 130
feet and upwards, and the Best Method of Recon-
struction..... { A. Shane,
Walter Ransom,
N. Potter,
C. G. Worden.
9.
Best Method of Elevating Track upon Bridges and
Trestles..... { H. E. Gettys,
S. F. Patterson,
G. W. Hinman,
P. A. Watson.

THIRD CONVENTION, PHILADELPHIA, PA., OCT. 17, 18, AND 19, 1892.

1.
Depressed Cinder Pits and Other Kinds..... { W. G. Berg,
Abel S. Markley,
G. W. Andrews,
C. E. Fuller.
2.
Best Method of Bridge Inspection..... { G. M. Reid,
J. M. Staten,
E. T. Wise,
J. S. Berry.
3.
Pumps and Boilers..... { G. W. Markley,
G. W. Turner,
J. B. Mitchell,
J. R. Harvey.
4.
Maintenance of Pile and Frame Trestle..... { W. A. McGonagle,
J. H. Markley,
Geo. C. Nutting,
John Copeland.
5.
The Best Scale Foundation..... { O. J. Travis,
Joseph Doll,
C. E. Wadley,
T. M. Strain.

FOURTH CONVENTION, KANSAS CITY, MO., OCT. 16, 17, AND 18, 1894.

1.
Mechanical Action and Resultant Effects of Motive
Power at High Speed on Bridges..... { G. W. Andrews,
W. G. Berg,
J. E. Greiner,
E. H. R. Green.
2.
Methods and Special Appliances for Building Tem-
porary Trestles over Washouts and Burnouts..... { R. M. Peck,
G. J. Bishop,
A. B. Manning,
C. D. Bradley.
3.
Strength of Various Kinds of Timber Used in Tres-
tles and Bridges, Especially with Reference to
Southern Yellow Pine, White Pine, Fir, and Oak... { W. G. Berg,
J. H. Cummin,
John Foreman,
H. L. Fry.

4. Best Method of Erecting Plate-Girder Bridges ... { H. M. Hall,
J. M. Staten,
G. W. Hinman,
J. N. Pullen.
5. Best and Most Economical Railway Track Pile-Driver..... { J. L. White,
A. C. Davis,
J. F. Mock,
James T. Carpenter.
6. Sand Dryers, Elevators, and Methods of Supplying Sand to Engines, including Buildings..... { Aaron S. Markley,
H. A. Hanson,
A. J. Kelley,
J. O. Thorn.
7. Span Limits for Different Classes of Iron Bridges, and Comparative Merits of Plate-Girders and Lattice-Bridges for Spans from 50 to 110 feet..... { W. A. McGonagle,
R. M. Peck,
W. M. Noon,
H. E. Gettys.
8. Best Method of Spanning Openings too Large for Box Culverts, and in Embankments too Low for Arch Culverts..... { James Stannard,
L. K. Spafford,
O. H. Andrews,
F. W. Tanner.
9. Best End Construction for Trestle Adjoining Embankments..... { G. M. Reid,
J. L. Soisson,
N. M. Markley,
R. J. Howell.
10. Interlocking Signals..... { J. H. Travis,
W. S. Danes,
R. L. Heflin,
J. A. Spangler.
11. Pumps and Boilers..... { John H. Markley,
O. J. Travis,
A. Shane,
G. W. Markley.

FIFTH CONVENTION, NEW ORLEANS, LA., OCTOBER 15 AND 16, 1895.

1. How to Determine Size and Capacity of Openings for Waterways..... { Aaron S. Markley,
J. S. Berry,
C. C. Mallard,
J. L. White.
2. Different Methods of Numbering Bridges. Should All Waterways be Numbered?..... { A. Shane,
W. O. Eggleston,
J. L. Slosson,
O. J. Travis.
3. Drawbridge Ends, Methods of Locking; and under this head include Locking of Turn-tables..... { H. M. Hall,
James Stannard,
H. Middaugh,
C. C. Mallard.
4. Protection of Trestles from Fire, including Methods of Construction..... { R. M. Peck,
T. H. Kelleher,
A. McNab,
W. M. Noon,
G. W. Hinman,
William Berry.
5. Local Stations for Small Towns and Villages, giving Plans of Buildings and Platforms..... { J. H. Cummin,
N. M. Markley,
J. H. Markley,
C. G. Worden.
6. Tanks, Size, Style, and Details of Construction, including Frost-proof protection to Tank and Pipes.. { W. O. Eggleston,
W. M. Noon,
A. McNab,
N. W. Thompson.

- 7.
- Shearing of Rivets in Plate-Girders and Cause
Thereof..... { J. M. Staten,
R. L. Heflin,
J. H. Travis,
G. M. Reid.
- 8.
- Best and Uniform System of Report Blanks for
Bridge and Building Department..... { G. J. Bishop,
W. O. Eggleston,
Onward Bates,
M. Riney.
- 9.
- Protection of Railroad Structures and Buildings
from Fire..... { R. M. Peck,
L. K. Spafford,
B. T. McIver.
10. Brought forward from 1894.
- Mechanical Action and Resultant Effects of Motive
Power at High Speed on Bridges..... { G. W. Andrews,
W. G. Berg,
J. E. Greiner,
E. H. R. Green.
11. Brought forward from 1894.
- Best and Most Economical Railway Track Pile-
Driver..... { J. L. White,
A. C. Davis,
J. F. Mock,
J. T. Carpenter,
G. W. Hinman.
12. Brought forward from 1894.
- Span Limits for Different Classes of Iron Bridges,
and Comparative Merits of Plate-Girders and Lat-
tice Bridges for Spans from 50 to 110 feet..... { W. A. McGonagle
R. M. Peck,
W. M. Noon,
H. E. Gettys,
G. J. Bishop,
Onward Bates.
13. Brought forward from 1894.
- Interlocking Signals..... { J. H. Travis,
W. S. Danes,
R. L. Heflin,
J. A. Spangler.
- SIXTH CONVENTION, CHICAGO, ILL., OCTOBER 20, 21, AND 22, 1896.
- 1.
- Methods of Heating Buildings where Three or More
Stoves are Now Used..... { J. H. Cummin,
George W. Hinman,
George W. Markley,
Wm. Berry.
- 2.
- The Most Suitable Material for Roofs of Buildings of
All Kinds..... { R. M. Peck,
G. W. Turner,
W. M. Noon,
N. W. Thompson.
- 3.
- Roundhouse Construction, including Smoke-jacks
and Ventilators..... { Geo. W. Andrews,
O. J. Travis,
W. O. Eggleston,
James T. Carpenter.
- 4.
- Care of Iron Bridges after Erection..... { James H. Travis,
T. M. Strain,
H. M. Hall,
Walter Rogers.
- 5.
- How to Determine Size and Capacity of Openings
for Waterways..... { Walter G. Berg,
Aaron S. Markley,
Onward Bates,
A. J. Kelley.

6.		
Protection of Railroad Buildings and Other Structures from Fire.....	{	W. A. McGonagle, M. M. Garvey, J. D. Hilderbrand, John Foreman.
7.		
Designs for Ice-Houses.....	{	W. B. Yereance, C. M. Large, J. H. Markley, Geo. W. Ryan.
8.		
Best End Construction for Trestles adjoining Embankments.....	{	C. C. Mallard, W. S. Danes, R. L. Heflin, A. C. Olney.
9.		
Bridge Warnings for Low Overhead Structures.....	{	W. E. Harwig, M. A. Martin, E. H. R. Green, Joseph Doll.
10.		
Stock-yards and Stock-sheds, including all Details of Construction.....	{	Geo. J. Bishop, W. R. Cannon, O. H. Andrews, James Brady.
11.		
Floor System on Bridges, including Skew Bridges...	{	W. G. Guppy, C. P. Austin, C. W. Gooch, F. W. Tanner.

SEVENTH CONVENTION, DENVER, COL., OCTOBER 19, 20, AND 21, 1897.

1.		
Pile-rings and Method of Protecting Pileheads in Driving.....	{	G. W. Hinman, Wm. S. Danes, F. Eilers, E. F. Reynolds, Wm. Carmichael, C. M. Large.
2.		
Cost and Manner of Putting In Pipe Culverts.....	{	Walter A. Rogers, Frank W. Tanner, John H. Markley, A. H. King, B. F. Bond, O. H. Andrews.
3.		
Best Floors for Shops and Roundhouses.....	{	A. W. Merrick, C. S. Thompson, Wm. O. Eggleston, M. F. Cahill, J. B. Pullen, James Gilbert.
4.		
Roundhouse Smoke-jacks and Ventilation.....	{	George W. Andrews, Wm. O. Eggleston, Aaron S. Markley, B. J. Howell, J. T. Carpenter, A. McNab.
5.		
Cattleguards and Wingfences.....	{	C. C. Mallard, C. S. Thompson, A. Zimmerman, L. H. Wheaton, O. W. Osborne, R. L. Heflin.
6.		
Prevention of Fire in Railroad Buildings.....	{	John D. Isaacs, Wm. A. McGonagle, M. Eliney, H. L. Fry, J. P. Snow, Wm. B. Yearance.

7.		
Storage of Fuel, Oil, and Other Station Supplies at Way-stations.....		{ Arthur Montzheimer, A. Shane, G. E. Hanks, J. E. Johnson, W. Z. Taylor, E. M. Gilchrist.
8.		
Railroad Highway Crossing Gates.....		{ Joseph H. Cummin. J. B. Sheldon, Wm. E. Harwig, G. W. Smith, J. E. Featherston, W. M. Noon.
9.		
What Repairs, and How Can they be Safely Made, to Metal and Wooden Spans Without the Use of False-work		{ F. S. Edinger, B. W. Guppy, J. E. Greiner, John D. Isaacs, Walter A. Rogers, H. W. Fletcher.
10.		
Care of Iron Bridges After Erection, including Best Method of Protecting Them From Injury by Salt Water Drippings from Refrigerator cars.....		{ J. E. Greiner, B. W. Guppy, James McIntyre, T. M. Strain, A. J. Kelley, L. F. Goodale.
11.		
Turntable Construction.....		{ Onward Bates, J. B. Sheldon, D. K. Colburn, John Foreman, E. Fisher, Henry Goldmark.

EIGHTH CONVENTION, RICHMOND, VA., OCTOBER 18 AND 19, 1898.

1.		
What is the Most Economical Method of Painting Railway Bridges and Buildings, and Best Material to use		{ A. Montzheimer, B. F. Pickering, H. D. Cleaveland, W. A. McGonagle.
2.		
Life of Different Kinds of Timber in Bridges of Various Kinds, and Advisability of Protecting Same from the Weather.....		B. W. Guppy.
3.		
The Best Method of Constructing and Maintaining Highway and Farm Crossings.....		{ J. H. Markley, W. O. Eggleston, T. M. Strain, O. J. Travis.
4.		
Best Practical Sanitary Arrangement for Local Stations where there are no Water or Sewer Systems.		{ W. A. Rogers, J. B. Sheldon, C. H. Miller, J. McIntyre.
5.		
Best and Most Economical Plant for Pumping Water for Water Stations.....		{ A. Shane, A. S. Markley, R. L. H. flin, W. E. Smith.
6.		
Necessary and Kind of Tools for the Proper Equipment of a Gang of Bridge Men.		{ G. J. Bishop, G. W. Hinman, M. Riney, A. Zimmerman.

7.

Best Snow Fence—Stationary and Portable { A. W. Merick,
A. E. Killam,
J. D. Isaacs,
A. H. King.

8. Brought forward from 1897.

What Repairs and How Can They Be Safely Made to { F. S. Edinger,
Metal and Wood Spans Without the Use of False { J. E. Greiner,
Work { J. D. Isaacs,
W. A. Rogers,
H. W. Fletcher.

9. Brought forward from 1897.

Prevention of Fire in Railroad Buildings..... { G. W. Andrews,
A. D. Schindler,
W. E. Smith,
S. B. Rice.

NINTH CONVENTION, DETROIT, MICH., OCTOBER 17 AND 18, 1898.

1. Brought forward from 1898.

Necessary and Kind of Tools for the Equipment of a { W. S. Danes,
Gang of Bridge Men..... { J. M. Staten,
W. O. Eggleston,
J. M. Caldwell.

2. Brought forward from 1898.

Best Snow Fence, Stationary or Portable..... { W. E. Smith,
A. McNab,
Geo. E. Hanks,
A. W. Merrick,
W. M. Noon.

3.

Best Method of Erecting Track Scales, Suspended { H. D. Cleveland,
or under Track..... { Wm. M. Clark,
C. P. Austin,
J. T. McIlwaine.

4.

Is Concrete the Most Suitable and Economical Mate- {
rial for Bridge Piers and Abutments and Railway { W. A. Rogers.
Culverts and Arches?.....

5.

Hand vs. Air-riveting Power Used. Actual Cost {
Compared with Hand Work in the Field for the { A. B. Manning,
Erection of New Work and Repairing; also Drill- { A. Shane,
ing for Reinforcing old Spans..... { Geo. J. Bishop,
O. J. Travis,
F. W. Tanner,
F. S. Edinger.

6.

Most Practical and Cheapest Bumper for Yard Ter- { B. F. Pickering,
minals..... { A. A. Page,
W. E. Harwig,
A. E. Killam.

7.

Are Tie Plates on Bridge Ties a Benefit or a Detri- {
ment?..... { C. A. Lichty,
A. Montzheimer,
C. W. Vandergrift,
H. W. Fletcher,
F. S. Edinger,
J. B. Sheldon.

TENTH CONVENTION, ST. LOUIS, MO., OCT. 16, 17, AND 18, 1906.

1. **Methods of Sinking Foundations for Bridge Piers in Depth of Water Twenty Feet and Under.....** { G. W. Andrews,
C. C. Mallard,
O. A. Lichty,
C. W. Gooch,
C. S. Thompson,
D. Robertson.
2. **Passenger Platforms at Way Stations, Best Material and Cost of Same.....** { J. B. Sheldon,
John I. Banks,
N. H. LaFountain,
L. H. Wheaton,
Wm. A. Fort,
A. McNab.
3. **Slips for Ferry Boats Used for Transferring Railway Cars.....** { John D. Isaacs,
H. D. Cleaveland,
J. H. Cummin,
Charles Carr,
H. Rettinghouse,
J. T. Carpenter.
4. **Best Method of Operating Turn-tables by Power....** { F. E. Schall,
J. E. Greiner,
B. F. Pickering,
Onward Bates.
5. **Auxiliary Coaling Stations; Best Design, Capacity, and Method of Handling Coal.....** { W. A. McGonagle,
G. W. Smith,
E. Fisher,
J. P. Snow,
B. F. Bond,
R. B. Tweedy.
6. **Water Stations; Best Material for Foundations, Tanks, Substructure, Connections, Capacity, etc...** { A. S. Markley,
Charles Carr,
W. O. Eggleston,
A. J. Austin,
A. Shane.
7. **Is it Best for Railroad Companies to Erect Their Own Steel Structures, or Let the Manufacturers Erect Them?.....** { O. J. Travis,
F. S. Edinger,
A. B. Manning,
James McIntyre,
A. Zimmerman.
8. **The Best and Most Convenient Outfit Cars for Bridge Gangs, and Number of Men Constituting a Bridge Gang.....** { A. W. Merrick,
S. S. Millener,
Wm. M. Clark,
A. A. Page,
M. F. Cahill,
W. E. Harwig,
G. O. Lilly.

ELEVENTH CONVENTION, ATLANTA, GA., OCT. 15, 16, AND 17, 1901.

1.

Auxiliary Coaling Stations; Best Designs, Capacity, and Method of Handling Coal. Brought forward from 1900.....	{ W. A. McGonagle, G. W. Smith, E. Fisher, J. P. Snow, B. F. Bond, R. B. Tweedy.
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2.

Roof Coverings, First Cost, Life, Efficiency, and Maintenance Expenses for Various Classes of Railroad Buildings	{ E. Fisher, R. H. Reed, J. S. Berry, J. P. Snow.
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3.

Mail Cranes, First Cost, Efficiency and Maintenance of Various Styles in Use.....	{ A. S. Markley, F. Price, James Brady, G. W. Smith, D. W. Lum.
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4.

Best Method of Protecting Low Overhead Structures Over Tracks from Gases and Blast of Locomotives.	{ G. W. Andrews, J. S. Lemonard, C. M. Large, A. H. King, James T. Carpenter, E. H. R. Green, A. E. Killam.
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5.

What has been the Experience in the Use of Concrete Under Bridge Bedplates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bedplates Under Various Styles of Iron Bridges?.....	{ W. A. Rogers, Frank W. Tanner, George J. Bishop, J. H. Markley, A. McNab, George E. Hanks.
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6.

Best Design and Recent Practice in Building Railroad Track Pile Driver.....	{ T. M. Strain, A. W. Merrick, Chas. C. Mallard, A. B. Manning, W. M. Noon, W. T. Powell.
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7.

Best Material and Designs for Roundhouse Pits, Including Drainage and Rail Fastings	{ Arthur Montzheimer, E. M. Gilchrist, J. W. Taylor, James Stannard, Onward Bates.
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8.

Best Materials for Wearing Surface of Roadway of Highway Bridge Floors.....	{ W. O. Eggleston, B. F. Peckering, A. B. Sheldon, C. P. Austin, Joseph M. Staten, O. J. Travis.
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TWELFTH CONVENTION, MINNEAPOLIS, MINN., OCT. 21 TO 23, 1902.

1. { John P. Canty,
H. H. Eggleston,
O. D. Killebrew,
F. F. Lloyd,
A. C. Macy,
J. E. Greiner.
- Best False Work for Rocky Bottom in Rapid Currents Where Piles Cannot be Driven.....
2. { R. H. Reid,
Onward Bates,
H. D. Cleaveland,
Henry Goldmark,
J. E. Johnson,
G. W. McGehee.
- Should Ties of Bridges be Gained so as to Leave Rail Without Camber, or Should Only a Portion of Camber Be Taken Out?.....
3. { John D. Isaacs,
F. E. Schall,
Geo. C. Nutting,
W. M. Noon,
A. McNab,
Geo. W. Andrews.
- In Case One Arm of an Important Metal Drawbridge Over a Deep Stream Should be Wrecked, What is the Most Expeditious Way to Restore Railway and Water Traffic?.....
4. { G. W. Smith,
O. J. Travis,
J. P. Snow,
C. W. Kelley,
Joseph M. Staten,
F. W. Tanner.
- What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to Two Hundred Feet?.....
5. { A. O. Cunningham
Geo. F. Powers,
D. W. Lum,
Albert C. Keith,
C. P. Austin,
F. E. Schall.
- Best Method of Protecting Solid Steel Floors of Bridges.....
6. { J. B. Sheldon,
H. E. Holmes,
W. E. Bell,
Geo. Mitchell,
Ed. Gagnon,
C. E. Walton.
- Best Plans for Small Tool Houses, Including Switchmen's and Car Repairers' Shanties, and Section, Tool, and Hand-car Houses.....
7. { J. H. Markley,
F. J. Leavitt,
Geo. J. Patterson,
E. B. Ashby,
T. J. Darracott,
A. W. Merrick.
- Best Practical Sanitary Arrangements for Small Stations Where There Are no Water or Sewer Systems.....
8. { Walter G. Berg,
J. A. Dodson,
C. F. Loweth,
Arthur Montzheimer,
A. Zimmerman,
A. Shane,
I. O. Walker.
- Best Method of Making Annual Inspection of Bridges and Culverts, and Form of Report to be Made.....
9. { R. C. Sattley,
J. E. Greiner,
Ed. M. Gilchrist,
Geo. E. Hanks,
A. B. Manning,
James Rogers.
- Water Filters, or Other Methods of Purifying Water for Engine Use.....

10.

- Best Method of Storing Fuel Oil, With Appliances for supplying Locomotives, Including Plan of Water Stations, Showing Relative Arrangements of Fuel and Water Supply.....**
- { C. C. Mallard,
J. S. Berry,
Geo. J. Bishop,
William Carmichael,
W. M. Clark,
I. W. Evans,
E. Fisher.

11.

- What Has Been the Experience in the Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges.....**
- { Walter A. Rogers,
A. Minster,
L. F. Goodale,
E. H. R. Green,
J. C. Hain,
E. P. Hawkins.

THIRTEENTH CONVENTION, QUEBEC, CANADA, OCT. 20 TO 22, 1903

1.

- What is the Best Form of Traveler to Use in Erecting Steel Railway Bridges of Spans up to 200 Feet..**
- { G. W. Smith,
Moses Burpee,
Geo. J. Bishop,
A. O. Cunningham,
J. C. Hain,
I. F. Stern.

2.

- What Has Been the Experience in Use of Concrete Under Bridge Bed-plates and Turn-tables in Place of Pedestal Stones, and What is the Best Form and Material for Bed-plates Under Various Styles of Iron Bridges (Continued from 1902).....**
- { C. F. Loweth,
T. M. Strain,
J. E. Johnson,
A. Minster,
D. W. Lum,
J. P. Snow.

3.

- Best Methods of Caring for Trestles While Being Filled.....**
- { A. H. King,
J. B. Sheldon,
H. D. Cleaveland,
A. J. Hart,
F. Ingalls,
J. S. Lemond.

4.

- Best Forms of Construction for Engine Houses.**
- { A. W. Merrick,
L. H. Wheaton,
R. L. Heflin,
C. W. Kelley,
C. C. Mallard,
A. B. Manning.

5.

- Best Methods of Filling Ice Houses and Conveying Ice to Refrigerator Cars.....**
- { J. T. Carpenter,
F. L. Burrell,
John P. Canty,
A. McNab,
O. M. Large,
G. Larson.

6.

- Best Methods of Filling Track Water Tanks Automatically.....**
- { E. B. Ashby,
Willard Beaham,
C. H. Miller,
Thomas S. Leake,
F. E. Schall,
L. F. Price.

7.

Steam Hammers Versus Drop Hammers for Pile-
drivers..... { O. J. Travis,
E. H. Reid,
N. H. LaFountain,
Frank J. Leavitt,
G. O. Lilly,
H. Rettinghouse.

8.

Best Form of Construction for Docks and Wharves.. { John D. Isaacs,
W. A. McGonagle,
Henry Goldmark,
G. J. Klump,
R. B. Tweedy,
G. F. Powers.

9.

Best Record Forms for Buildings, Water Tanks, etc. { B. J. Sweatt,
B. F. Pickering,
A. Shane,
I. O. Walker,
J. F. White,
William E. Harwig.

10.

Best Freight and Roundhouse Doors, and Fittings
for the Same..... { John I. Banks,
James McIntyre,
R. K. Ross,
Ed. Gilchrist,
George W. Welker.

11.

Best Methods for Preserving Timber and Piles in
Structures..... { Wm. F. Steffens,
John D. Isaacs,
Geo. A. Mountain,
E. Loughery,
C. C. Witt,
B. F. Bond.

12.

Best Methods of Protecting Low Overhead Struc-
tures Over Tracks from Gases and Blast of Loco-
motives..... { B. W. Guppy,
Grosvenor Aldrich,
F. F. Lloyd,
Robert J. Bruce,
Wm. M. Clark,
J. S. Berry.

1

FOURTEENTH CONVENTION, CHICAGO, ILL., OCTOBER 18 TO 20, 1904.

1.

Construction and Maintenance of Docks and Wharves.	{	H. Rettinghouse, W. A. McGonagle, A. A. Page, J. S. Browne, W. M. Noon, L. J. Anderson, L. D. Smith.
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2.

Relative Value of Concrete and Timber Piles.....	{	W. H. Finley, J. O. Hain, W. A. Rogers, D. W. Lum, W. S. Dawley, L. F. Goodale.
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3.

Concrete Building Construction, Including Platforms.	{	C. W. Bichey, A. O. Cunningham, C. F. Loweth, G. A. Wright, F. P. Gutelius.
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4.

Anchors for Plows and Derricks	{	R. J. Arey, A. J. Ross, E. Loughery, M. Bishop.
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5.

Methods of Repairing Roofs of Various Kinds.....	{	J. N. Penwell, A. W. Merrick, G. C. Larson, H. W. Phillips, C. F. Flint, Floyd Ingram.
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6.

Methods of Watering Stock in Transit	{	J. O. Thorn, B. J. Sweatt, F. O. Draper, F. Ingalls, F. L. Park.
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7.

Protection of Water Tanks and Water Pipes from Action of Frost.....	{	J. P. Canty, J. Parks, A. Findley, F. L. Burrell, K. J. C. Zinck.
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8.

Recent Practice in Cofferdam Work.....	{	W. F. Steffens, F. E. Schall, G. J. Klumpp, R. H. Reid, Wm. Kleefeld, Jr.
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STANDING COMMITTEES.—FOURTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges.....	{	F. S. Edinger, W. M. Clark, I. F. Stern, W. E. Alexander, J. C. Taylor.
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2.

Steel Bridges.....	{	H. H. Eggleston, J. P. Snow, C. H. Cartledge, H. M. Trippe, J. W. Lantry.
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3.

Buildings.....	{	E. Du Bois Brown, W. A. Pettis, W. C. Halsey, T. S. Leake.
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4.

Docks and Wharves.....	{	R. Angst, W. J. Mellor, John I. Banks, K. S. Hull, A. McDonald.
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5.

Water Supply.....	{	B. M. Hudson, F. J. Leavitt, D. C. Zook, Charles Carr, J. H. Howe.
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6.

Fire Protection	{	Geo. W. Andrews, R. A. Nickerson, Wm. H. Keen, H. A. Horning.
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7.

Fences, Crossings and Cattle Guards.....	{	C. S. Corrigan, C. F. King, J. S. Berry, Walter Hurst, Burton Marye.
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8.

Preservatives for Wood and Metals.....	{	F. D. Beal, J. F. Parker, E. Fisher, J. C. Beye, C. A. Thanheiser.
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9.

Coaling Stations and Cinder Pits.....	{	W. B. Causey, R. M. Drake, J. W. McCormack Willard Beaham.
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10.

Records and Accounts	{	H. M. Henson, R. C. Sattley, Ed. Gagnon, E. R. Floren.
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FIFTEENTH CONVENTION, PITTSBURG, PA., OCTOBER 17 TO 19, 1905.

1.
Concrete Bridges, Arches and Subways..... { N. H. LaFountain,
E. H. Reid,
G. E. Hanks,
A. S. Markley,
H. D. Cleaveland,
M. Burpee.
2.
Experience and Use of Concrete and Timber Piles..... { W. H. Finley,
E. N. Layfield,
W. S. Dawley,
L. D. Smith.
3.
Concrete Building Construction..... { C. W. Richey,
W. W. Perry,
Charles Carr,
E. P. Mills,
W. B. Yearance,
E. L. Heflin.
4.
Method of Watering Stock in Transit..... { J. N. Penwell,
U. A. Horn,
M. R. Williams,
C. F. King,
G. F. Powers,
J. C. Taylor.
5.
Recent Practice in Cofferdam Work..... { W. F. Steffens,
G. Aldrich,
W. A. Fort,
E. P. Hawkins.
6.
Modern Coaling Stations and Cinder Pits..... { J. S. Browne,
F. B. Scheetz,
D. W. Lum,
G. H. Soles,
F. P. Gutelius.
7.
Bumping Blocks for Passenger and Freight Use..... { A. E. Killam,
Thos. S. Leake,
F. L. Burrell,
J. M. Staten,
A. B. Hubbard.

COMMITTEES ON STANDING SUBJECTS.—FIFTEENTH CONVENTION.

1.

Pile and Frame Trestle Bridges.....	{	J. P. Canty, K. S. Hull, J. E. Johnson, W. O. Eggleston, H. F. Morrill.
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2.

Steel Bridges.....	{	A. O. Cunningham, W. H. Wilkinson, J. P. Snow, W. M. Kleeefeld, F. E. Schall.
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3.

Buildings.....	{	W. B. Causey, F. Ingram, Walter Hurst, J. M. Caldwell.
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4.

Water Supply.....	{	B. M. Hudson, H. Bettinghouse, M. Riney, J. L. Talbott, M. Bishop.
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5.

Fire Protection	{	Geo. W. Andrews, R. A. Nickerson, W. H. Keene, D. C. Zook.
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6.

Fences, Road Crossings and Cattle Guards.....	{	A. Findley, J. Hartley, A. McDonald, Geo. J. Patterson, M. F. Tucker.
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7.

Preservatives for Wood and Metals.....	{	F. D. Beal, R. J. Arey, H. Small, W. A. McGonagle.
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8.

Records and Accounts	{	R. C. Sattley, J. S. Lemon, James Stannard, J. C. Beye.
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SIXTEENTH CONVENTION, BOSTON, MASS., OCTOBER 16 TO 18, 1906.

1.

Experience in Concrete Bridges, Arches and Sub-ways..... { W. H. Finley,
McClellan Bishop,
W. B. Causey,
R. C. Sattley.

2.

Concrete Building Construction..... { A. O. Cunningham,
B. E. Leffler,
T. J. Fullem,
M. Biney.

3.

Experience as to Expansion and Contraction of Concrete Walls, either Reinforced or Plain Concrete... { A. S. Markley,
W. A. Rogers,
R. H. Reid,
P. J. O'Neil.

4.

Action of Sea Water on Concrete. A. Concrete Made in Air and Sunk into Sea Water. B. Concrete Deposited direct into Sea Water { Grosvenor Aldrich,
Willard A. Pettis,
George W. Andrews,
John E. Barrett.

5.

Recent Experience in the Use of Wooden and Asbestos Smoke Jacks for Engine Houses..... { J. H. Cummin,
M. J. Flynn,
A. F. Miller,
D. L. McKee.

6.

Combination Fastenings and Locks for Rolling and Sliding Doors on Freight Houses and other Buildings..... { C. A. Lichty,
H. Rettinghouse,
John L. Talbott,
W. T. Powell.

7.

Construction of Towers and Guides for Lights on Drawbridges..... { John N. Penwell,
Floyd Ingram,
George W. Rear,
G. J. Klumpp.

8.

Recent Experience in Protecting Steel Railroad Bridges against the Action of Salt Brine from Refrigerator Cars..... { R. P. Mills,
A. Montzheimer,
Walter G. Berg,
F. O. Draper,
Charles Carr.

COMMITTEES ON STANDING SUBJECTS.—SIXTEENTH CONVENTION.

1.
Pile and Frame Trestle Bridges..... { W. E. Smith,
J. S. Berry,
John C. Beye,
E. R. Floren.
2.
Water Supply..... { C. E. Thomas,
J. M. Caldwell,
B. F. Bond,
A. C. Blake.
3.
Fire Protection..... { Wm. C. Carmichael,
D. A. Shope,
A. Shane,
S. F. Clapp.
4.
Fences, Road Crossings and Cattle Guards..... { W. M. Noon,
A. McNab,
W. A. Fort,
F. W. Tanner.
5.
Preservatives for Wood and Metals..... { J. F. Parker,
R. J. Arey,
James Fraser,
J. S. Lemond,
R. J. Bruce.

SEVENTEENTH CONVENTION, MILWAUKEE, WIS., OCT. 15 TO 17, 1907.

1.
Waterproofing of Concrete Covered Steel Floors and
Subways..... { A. F. Miller,
A. L. Bowman,
A. A. Page,
J. F. Stern.
2.
Modern Equipment and Tools for Erection of Steel
Bridges..... { J. Hunciker,
W. H. Wilkinson,
G. J. Klumpp,
B. F. Pickering,
A. E. Killam.
3.
Protection of Structures Against the Effects of Elec-
tric Currents { C. W. Richey,
W. A. Rogers,
A. D. Schindler,
R. P. Mills.
4.
Protection of Embankments from the Effects of
High Water by Rip-Rap or otherwise..... { G. H. Soles,
F. Ingalls,
J. C. Beye,
J. S. Berry,
W. B. Rogers.

5. Experience in the Use of Gasoline and Kerosene Engines, or Combination of Same for Water Supply, Draw-bridges, etc..... { A. S. Markley,
E. D. B. Brown,
P. Swenson,
P. J. O'Neill,
A. W. Merrick.
6. Modern Dwelling House for Section Foremen and Section Men in Outlying Districts..... { W. Beaham,
W. A. McGonagle,
C. H. Biss,
Thomas J. Leake,
Charles Carr,
W. E. Harwig.
7. Re-inforced Concrete Culverts and Short Span Bridges..... { A. O. Cunningham,
W. O. Eggleston,
James Rogers,
C. F. Loweth,
P. Aagaard.
8. Methods of Erecting Truss Bridges { M. Riney,
C. W. Richey,
F. B. Scheetz,
G. W. Smith,
O. J. Travis,
Phelps Johnson,
James D. Gilbert.
- a. Maintaining Traffic.....
b. No Traffic ...
9. Smoke Jacks for Engine Houses..... { C. A. Lichty,
J. P. Canty,
H. D. Cleaveland.

COMMITTEES ON STANDING SUBJECTS.—SEVENTEENTH CONVENTION.

1. Pile and Frame Trestle Bridges { E. M. Tripp,
T. J. Fullem,
A. G. Bennett,
J. C. Taylor,
D. Robinson,
J. H. Howe,
H. A. Horning.
2. Fire Protection..... { J. N. Penwell,
A. B. Hubbard,
D. C. Zook.
3. Fences, Road Crossings and Cattle Guards..... { J. E. Barrett,
C. P. Austin,
G. F. Powers.
4. Construction of Cofferdams..... { J. H. Markley,
J. P. Snow,
F. O. Draper,
W. J. George.
5. Preservation of Timber..... { J. E. Schall,
F. D. Beal,
W. F. Steffens.

CONSTITUTION.

ARTICLE I.

NAME.

SECTION 1. This Association is known as the "Association of Railway Superintendents of Bridges and Buildings."

ARTICLE II.

OBJECT.

SECTION 1. The object of this Association shall be the mutual advancement of its members, by the acquirement of more perfect knowledge in the construction, maintenance, and repair of railroad bridges and buildings, as well as all other matters entrusted to the care of superintendents of bridges and buildings, by common discussion, interchange of ideas, reports, and investigations of its members.

ARTICLE III.

MEMBERSHIP.

SECTION 1. Any person at the head of a bridge and building department on any railroad, or a division or subdivision, and to include assistant superintendent and general foreman of any railroad, shall be eligible to membership in this Association upon application to the secretary and the payment of \$3.00 membership fee and \$2.00 for one year's dues, membership to continue until written resignation is received by the secretary, unless member has been previously expelled.

SEC. 2. Any member guilty of dishonorable conduct, or conduct unbecoming a railroad official and member of this Association, or who shall refuse to obey the chairman, or rules of this Association, may be expelled by a two-thirds vote of the members present.

SEC. 3. Any member elected a Life Member of this Association, shall have all of the privileges of an active member, but shall not be required to pay annual dues.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of this Association shall be a president, four vice-presidents, a secretary, a treasurer, and six executive members. The executive members, together with the president, secretary, and treasurer, shall constitute the Executive Committee.

All Past-Presidents of this Association, who continue to be members, shall be entitled to be present at all meetings of the Executive Committee, of which meetings they shall receive due notice, and be permitted to discuss all questions coming before the Executive Committee and to aid said committee by their advice and counsel; but, said Past-Presidents shall not have a right to vote, nor shall their presence be requisite in order to constitute a quorum.

ARTICLE V.

DUTIES OF OFFICERS.

SECTION 1. The duties of officers shall be such as prescribed by by-laws, as pertain to officers of like character, general, or may be assigned them by the Executive Committee.

ARTICLE VI.

EXECUTIVE COMMITTEE.

SECTION 1. The Executive Committee shall exercise a general supervision over the financial and other interests of the Association, assess the amount of annual and other dues, call, prepare for, and conduct general or special meetings, make all necessary purchases and contracts required to conduct the general business of the Association, but shall not have power to render the Association liable for any debt beyond the amount then in the treasurer's hands not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the Association.

SEC. 2. The Executive Committee shall report the proceedings of its meetings, making such reports accessible to members; it shall publish the proceedings of all meetings of the Association, subject to the approval of the Association.

SEC. 3. Two-thirds of the members of the Executive Committee may call special meetings, sixty days' notice being given members by mail.

SEC. 4. Five members of the Executive Committee shall constitute a quorum for the transaction of business.

ARTICLE VII.

ELECTION OF OFFICERS AND TENURE OF OFFICE.

SECTION 1. The officers, excepting as otherwise provided, shall be elected at the regular meeting of the Association, held on third Tuesday in October of each year, and the election shall not be postponed except by unanimous consent.

PRESIDENT AND TREASURER.

SEC. 2. The president and treasurer shall be elected by ballot by a majority of votes cast, and shall hold office for one year, or until successors are elected.

VICE-PRESIDENTS AND EXECUTIVE MEMBERS.

SEC. 3. The vice-presidents shall hold office for one year and executive members for two years, four vice-presidents, and three executive members to be elected each year; provided, however, that three of the executive members be appointed by the president at the adoption of this constitution. All officers herein named to hold office until successors are chosen at next annual meeting.

SEC. 4. In the election of vice-presidents, each one shall be elected by a majority vote. Executive members will be elected in the same way, all voting to be by written ballots.

SECRETARY.

SEC. 5. A secretary shall be elected by a majority of the votes of the members present at the annual meeting. The term of office of the secretary shall be for one year, unless terminated sooner by action of the Executive Committee, two-thirds of whom may remove the secretary at any time. His compensation shall be fixed by a majority of the Executive Committee. The secretary shall also be secretary of the Executive Committee.

TREASURER.

SEC. 6. The treasurer shall be required to give bond in an amount to be fixed by the majority of the Executive Committee.

ARTICLE VIII.

COMMITTEES.

SECTION 1. At the first session of the annual meeting the president shall appoint a committee of three members, not then officers of the Association, who shall send names of nominees for officers of the Association for the ensuing year to the secretary, before the election of officers is in order, and the names shall be announced as soon as received. The election shall not be held until the day after announcement, except by unanimous consent. Nothing in this section shall be construed to prevent any members from making nominations.

AUDITING COMMITTEE.

SEC. 2. At the first session of each annual meeting there shall be appointed by the president an auditing committee of three members, not officers of the Association, whose duty it shall be to examine the accounts and vouchers of the treasurer and certify as to the correctness of his accounts. Acceptance of this committee's report will be regarded as the discharge of the committee.

COMMITTEES ON SUBJECTS FOR DISCUSSION.

SEC. 3. At the annual meeting there shall be appointed by the president a committee, whose duty it shall be to prepare and report subjects for discussion and investigation at the next annual meeting. If subjects are approved by the Association, the presi-

dent shall appoint a committee to report on them. It shall be the duty of the committee to receive from members questions for discussion during the time set apart for that purpose. This committee shall be the judge of whether such questions are suitable ones for discussion, and if so, report them to the Association.

COMMITTEES ON INVESTIGATION.

SEC. 4. When the committee on subjects has reported and the Association approved of the same, the president shall appoint special committees to investigate and report on said subjects and he may appoint a special committee to investigate and report on any subject which a majority of members present may approve of.

ARTICLE IX.

ANNUAL DUES.

SECTION 1. Every member shall pay to the treasurer three dollars membership fee, and shall also pay two dollars per year in advance to defray the necessary expenses of the Association. No member being one year in arrears for dues will be entitled to vote at any election, and any member one year in arrears may be stricken from the list of members at the discretion of the Executive Committee.

ARTICLE X.

AMENDMENTS.

SECTION 1. This constitution may be amended at any regular meeting by a two-thirds vote of members present, provided that a written notice of the proposed amendment has been given at least ninety days previous to said regular meeting.

BY-LAWS.

TIME OF MEETING.

1. The regular meeting of this Association shall be held annually on the third Tuesday in October.

HOUE OF MEETING.

2. The regular hour of meeting shall be at 10 o'clock a. m.

PLACE OF MEETING.

3. The cities or places for holding the annual convention may be proposed at any regular meeting of the Association before the final adjournment. The places proposed shall be submitted to a ballot vote of the members of the Association, the city or place receiving a majority of all the votes cast to be declared the place of the next annual meeting; but if no place received a majority of all votes, then the place receiving the lowest number of votes shall be dropped on each subsequent ballot until a place is chosen.

QUORUM.

4. At the regular meeting of the Association, fifteen or more members shall constitute a quorum.

ORDER OF BUSINESS.

5. 1st—Calling of roll.
- 2d—Reading minutes of last meeting.
- 3d—Admission of new members.
- 4th—President's address.
- 5th—Reports of secretary and treasurer.
- 6th—Payment of annual dues.
- 7th—Appointment of committees.
- 8th—Reports of committees.
- 9th—Unfinished business.
- 10th—New business.
- 11th—Reading and discussion of questions propounded by members.
- 12th—Miscellaneous business.
- 13th—Election of officers.
- 14th—Adjournment.

DUTIES OF OFFICERS.

6. It shall be the duty of the president to call the meeting to order at the appointed time; to preside at all meetings; to announce the business before the Association, and to decide all questions of order and sign all orders drawn on the treasurer.

7. It shall be the duty of the vice-presidents, in the absence of the president, to preside at all meetings of the Association, in their order named.

8. It shall be the duty of the secretary to keep a correct record of proceedings of all meetings of this Association; to keep correct all accounts between this Association and its members; collect all moneys due the Association, and pay the same over to the treasurer and take his receipt therefor, and to perform such other duties as the Association may require.

9. It shall be the duty of the treasurer to receive and receipt to the secretary for all moneys received from him, and pay all orders authorized by the Association.

DECISIONS.

10. The votes of a majority of members present shall decide any question, motion, or resolution which shall be brought before the Association, unless otherwise provided.

DISCUSSIONS.

11. All discussions shall be governed by Roberts' Rules of Order.

DIRECTORY OF MEMBERS.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

OCTOBER, 1907.

A.

- AAGAARD, P., Ill. Cent. R. R., Chicago, Ill.
ALDRICH, GROSVENOR, N. Y., N. H. & H. R. R., Readville, Mass.
ALEXANDER, W. E., Bangor & Aroostook Railroad, Houlton, Me.
AMOS, ALEXANDER, Minn., St. P. & S. Ste. M. Ry., Minneapolis, Minn.
ANDERSON, AUGUST, Lake Superior & Ishpeming Ry., M. Ry. & Marquette & So. Eastern Ry., Marquette, Mich.
ANDERSON, J. W., Cin., Hamilton & Dayton Ry., Chillicothe, Ohio.
ANDERSON, L. J., C. & N. W. Ry., Escanaba, Mich.
ANDREWS, GEO. W., Asst. Engr. M. of W., B. & O. R. R., B. & O. Building, Baltimore, Md.
ANDREWS, O. H., St. Jo. & G. I. Ry., St. Joseph, Mo.
AREY, RALPH J., Div. Engr., A., T. & S. F. Ry. (Coast Lines), San Bernardino, Cal.
ASHBY, E. B., Engr. M. of W., L. V. R. R., So. Bethlehem, Pa.
AUSTIN, CYRUS P., Boston & Maine R. R., Medford, Mass.

B

- BAILEY, F. W., M., K. & T. Ry., Denison, Tex.
BAILEY, S. D., Michigan Central R. R., Detroit, Mich.
BALL, EDGAR E., Asst. Engr., A., T. & S. F. Ry. (Coast Lines), Williams, Ariz.
BANKS, JOHN I., Virginia Ry., 913 12th St., Norfolk, Va.
BARRETT, E. K., Fla. E. Coast Ry., St. Augustine, Fla.
BARRETT, JOHN E., Supt. Track and B. & B., L. & H. R. Ry., Warwick, N. Y.
BARTLES, F. R., Nor. Pacific Ry., Fargo, N. D.
BATES, ONWARD, C. E., Ellsworth Building, 355 Dearborn St., Chicago, Ill.

- BATTEY, CHARLES C., Boston & Maine R. R., Concord, N. H.
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WILSON, E. E., N. Y. C. & H. R. R. R., 138th St., Mott Haven,
N. Y. City.

WINTER, A. E., Div. Engr., C. & N. W. Ry., Escanaba, Mich.

WITT, CARL C., Engr., in Charge of Railway Appraisals, Siou:
Falls, S. D.

WOOD, WM. E., Div. Engr., C., M. & St. P. Ry., Marion, Iowa.

WOLF, A. A., C., M. & St. P. Ry., Milwaukee, Wis.

WRIGHT, G. A., C. & E. I. R. R., Danville, Ill.

Y

- YAPPEN, ADOLPH, C., M. & St. P. Ry., Chicago, Ill.
 YEREAHOE, WM. B., C. E., 418 Center St., South Orange, N. J.
 YOUNG, ROSCOE C., Chief Engr., Lake Superior & I. Ry., M. & S.
 E. Ry., Marquette, Mich.

Z

- ZINCK, K. J. C., Locating Engr., C. P. Ry., 237 Notre Dame St.,
 West Montreal.
 ZINSMEISTER, E. C., B. & O. R. R., Zanesville, O.
 ZOOK, D. C., Penn. Lines West of Pittsburg, Ft. Wayne, Ind.

LIFE MEMBERS.

- CRANE, HENRY, C. & N. W. Ry., Janesville, Wis.
 CUMMIN, JOSEPH H., Bay Shore, N. Y.
 FLETCHER, HOLLAND W., 1813 Termon Ave., Allegheny, Pa.
 FOREMAN, JOHN, Phila. & Read. R. R., Pottstown, Pa.
 GREEN, E. H. R., Tex. Mid. R. R., Terrell, Tex.
 MCINTYRE, JAMES, Miami, Fla.
 MORRILL, H. P., C. & N. W. Ry., Madison, Wis.
 VANDEGRIFT, C. W., C. & O. Ry., Roncerverte, W. Va.
 WALDEN, W. D., C. & N. W. Ry., Clinton, Ia.
 WISE, E. F., Ill. Cent. R. R., Waterloo, Ia.

DECEASED MEMBERS.

- BRADY, JAMES C., R. I. & P. Ry., Davenport, Ia.
 DEMARS, JAMES, Wheeling & L. Erie R. R., Norwalk, Ohio.
 DUNLAP, H., Wabash R. R., Andrews, Ind.
 FULLER, C. E., T. H. & I. R. R., Terre Haute, Ind.
 GRAHAM, T. B., Nor. Pac. Ry., Little Falls, Minn.
 HALL, H. M., O. & M. Ry., Olney, Ill.
 HINMAN, G. W., Louisville & Nashville R. R., Evansville, Ind.
 HUMPHREYS, THOMAS, So. Pac. Co., Bakersfield, Cal.
 ISADELL, L. S., O. & M. R. R., Lawrenceburg, Ind.
 KEEN, WM. H., N. Y., N. H. & H. R. R., Hartford, Conn.
 LOVETT, J. W., Southern Ry., Atlanta, Ga.

- MARKLEY, ABEL S., Pittsburg & Western Ry. Co., Allegheny, Pa.
 MCCORMACK, J. W., C., St. P., M. & O. Ry., Altoona, Wis.
 MCGEEHEE, G. W., Mobile & Ohio R. R., Okolona, Miss.
 MILLINER, S. S., B. & O. S. W. Ry., Washington, Ind.
 MITCHELL, J. B., C., C., C. & St. L. Ry., Indianapolis, Ind.
 MITCHELL, W. B., N. Y., P. & O. R. R., Galion, Ohio.
 MORGAN, T. H., Gulf, Col. & S. F. Ry., Cleburne, Tex.
 PECK, R. M., Missouri Pac. & St. L., I. M. & S. Ry., Pacific, Mo.
 REID, GEORGE M., L. S. & M. S. Ry., Cleveland, Ohio.
 SCHWARTZ, JOHN C., C., St. P., M. & O. Ry., Emerson, Neb.
 SPAFFORD, L. K., K. City, Fort Scott & Memphis Ry., Kansas City,
 Mo.
 SPANGLER, J. A., B. & O. Ry., Washington, Pa.
 TAYLOR, J. W., Terminal R. R. Association of St. Louis, St. Louis,
 Mo.
 THOMPSON, N. W., P., F. W. & C. Ry., Ft. Wayne, Ind.
 TOZZER, WILLIAM S., C. & O. R. R., Cincinnati, Ohio.
 TRAUTMAN, J. J., S. C. R. R., Edgefield, S. C.
 WALLACE, J. E., Wabash R. R., Springfield, Ill.
 WORDEN, C. G., S. F. Pac. R. R., Winslow, Ariz.

MEMBERSHIP AND MILEAGE OF RAILWAYS REPRESENTED IN THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

Name of Road and Membership.	Members.	Mileage.
Arizona & Colorado R. R.....	1	17
J. W. Reagan, Farmington, N. M.		
A. Q. & W. Railway of Canada.....	1
J. V. Nemmo, Paspebiac, Que.		
Atchison, Topeka & Santa Fé Railway.....	6	5,273
F. M. Clough, San Marcial, N. M.		
J. D. Gilbert, Topeka, Kan.		
E. McCann, Wellington, Kan.		
John L. Talbott, Pueblo, Col.		
J. M. Wells, Chillicothe, Ill.		
M. R. Williams, Las Vegas, N. M.		
Atchison, Topeka & Santa Fé Railway (Coast Lines)	4	1,980
R. J. Arey, San Bernardino, Cal.		
E. E. Ball, Winslow, Ariz.		
J. F. Parker, San Bernardino, Cal.		
D. A. Shope, Fresno, Cal.		
Atlanta & West Point Railroad, and Western Railway of Alabama.....	1	225
O. T. Nelson, Montgomery, Ala.		
Baltimore & Ohio Railroad, and B. & O. S. W. R. R.	9	4,471
G. W. Andrews, Baltimore, Md.		
W. M. Clark, Youngstown, O.		
William Graham, Baltimore, Md.		
J. E. Greiner, Baltimore, Md.		
W. T. Hopke, Grafton, W. Va.		
J. T. McIlwain, Akron, O.		
William Renton, Garrett, Ind.		
S. C. Tanner, Cumberland, Md.		
E. C. Zinsmeister, Zanesville, O.		
Bangor & Aroostook Railroad.....	3	489
W. E. Alexander, Houlton, Me.		
M. Burpee, Houlton, Me.		
R. D. Coombs, Houlton, Me.		

	Members.	Mileage.
Bessemer & Lake Erie Railroad.....	1	216
H. D. Cleaveland, Greenville, Pa.		
Boston & Maine Railroad.....	15	2,288
Cyrus P. Austin, Medford, Mass.		
C. C. Battey, Concord, N. H.		
J. P. Canty, Fitchburg, Mass.		
John Ewart, Boston, Mass.		
Andrew B. Hubbard, Boston, Mass.		
F. J. Leavitt, Sanbornville, N. H.		
William A. Lydston, Salem, Mass.		
Albert Mountfort, Nashua, N. H.		
A. A. Page, Boston, Mass.		
S. F. Patterson, Concord, N. H.		
B. F. Pickering, Sanbornville, N. H.		
Fred C. Rand, Boston, Mass.		
F. A. Sherwin, Springfield, Mass.		
J. P. Snow, Boston, Mass.		
E. C. Spaulding, St. Johnsbury, Vt.		
Buffalo, Rochester & Pittsburg Railway.....	2	558
D. J. Carson, Du Bois, Pa.		
E. J. Govern, Rochester, N. Y.		
Canada Atlantic Railway.....	1	468
George A. Mountain, Ottawa, Ont.		
Canadian Pacific Railway.....	4	9,425
F. P. Gutellus, Montreal, P. Q.		
C. N. Monsarrat, Montreal, P. Q.		
P. B. Motley, Montreal, P. Q.		
W. F. Tye, Montreal, P. Q.		
Central of Georgia Railway.....	1	1,913
H. C. McKee, Macon, Ga.		
Central Railroad of New Jersey.....	1	646
A. L. Bowman, Broadway, N. Y. City.		
Central Vermont Railway.....	4	536
J. E. Cole, St. Albans, Vt.		
C. F. Flint, St. Albans, Vt.		
H. E. Holmes, New London, Conn.		
G. J. Patterson, Waterbury, Vt.		
Chesapeake & Ohio Railway.....	2	1,632
J. M. Staten, Richmond, Va.		
C. W. Vandegrift, Ronceverte, W. Va.		

	Members.	Mileage.
Chicago & Alton Railway.....	2	1,004
W. B. Causey, Bloomington, Ill.		
H. H. Eggleston, Bloomington, Ill.		
Chicago & Eastern Illinois Railroad.....	2	823
A. S. Markley, Danville, Ill.		
G. A. Wright, Danville, Ill.		
Chicago & North Western Railway.....	34	7,363
L. J. Anderson, Escanaba, Mich.		
F. L. Burrell, Fremont, Neb.		
Henry Crane (retired), Janesville, Wis.		
William Curtin, Boone, Ia.		
W. H. Finley, Chicago, Ill.		
H. W. Fletcher (retired), Allegheny, Pa.		
M. J. Flynn, Chicago, Ill.		
W. C. Halsey, Eagle Grove, Ia.		
John Hunciker, Chicago, Ill.		
J. W. Irwin, Chadron, Neb.		
Lee Jutton, Chicago, Ill.		
C. F. King, Norfolk, Neb.		
C. A. Lichty, Chicago.		
George Loughnane, Mason City, Ia.		
W. T. Main, Chicago, Ill.		
C. A. Marcy, Chicago, Ill.		
A. W. Merrick, Boone, Ia.		
H. P. Morrill (retired), Madison, Wis.		
H. Rettinghouse, Boone, Ia.		
E. F. Reynolds, Antigo, Wis.		
M. Riney, Baraboo, Wis.		
J. S. Robinson, Chicago, Ill.		
D. Rounseville, Kaukauna, Wis.		
A. R. Shedd, Chicago, Ill.		
I. F. Stern, Chicago, Ill.		
W. Sweeney, Fond du Lac, Wis.		
L. H. Taylor, Chicago, Ill.		
W. J. Towne, Chicago, Ill.		
H. M. Trippe, Chicago, Ill.		
H. A. Walden, Boone, Ia.		
W. D. Walden (retired), Clinton, Ia.		
J. B. White, Boone, Ia.		
A. E. Winter, Escanaba, Mich.		
C. C. Witt, Chicago, Ill.		

	Members.	Mileage.
Chicago, Burlington & Quincy R. R.,.....	3	8,874
E. M. Gilchrist, Centerville, Ia.		
W. Hurst, St. Joseph, Mo.		
J. O. Thorne, Beardstown, Ill.		
Chicago, Indianapolis & Louisville Railway....	1	586
J. M. Caldwell, Lafayette, Ind.		
Chicago, Lake Shore & Eastern Railway.....	1	165
C. Thompson, Chicago, Ill.		
Chicago, Milwaukee & St. Paul Railway.....	11	7,058
A. G. Bennett, Minneapolis, Minn.		
H. R. Drum, Chamberlain, S. D.		
T. L. D. Hadwen, Marion, Ia.		
F. E. King, Milwaukee, Wis.		
N. H. LaFountain, Chicago, Ill.		
C. F. Loweth, Chicago, Ill.		
William Ross, Milbank, S. D.		
Fred E. Weise, Chicago, Ill.		
William E. Wood, Marion, Ia.		
A. A. Wolf, Milwaukee, Wis.		
A. Yappen, Chicago, Ill.		
Chicago, Rock Island & Pacific Railway.....	4	7,358
McClellan Bishop, Chickasha, I. T.		
E. R. Floren, Fairbury, Neb.		
F. L. Park, Topeka, Kan.		
J. D. Upp, Colorado Springs, Col.		
Chicago, St. Paul, Minneapolis & Omaha Rail- way	3	1,718
G. Larson, Spooner, Wis.		
W. B. Rogers, Emerson, Neb.		
E. T. Welch, Mankata, Minn.		
Chicago Southern Railway.....	1	
J. E. Pickens, Watseka, Ill.		
Chicago Terminal Transfer Railroad.....	1	277
E. N. Layfield, Chicago, Ill.		
Cincinnati, Hamilton & Dayton Railway....	2	1,038
J. W. Anderson, Chillicothe, O.		
I. F. White, Dayton, O.		
Cincinnati Northern Railroad.....	1	236
J. M. Wilkinson, Van Wert, O.		

	Members.	Mileage.
Colorado & Southern Railway.....	1	1,272
W. T. Powell, Denver, Col.		
Colorado Springs & Cripple Creek Dist. Ry.....	1	105
B. A. Briggs, Cripple Creek, Col.		
Denver, Enid & Gulf Railroad.....	1	120
J. D. Lacy, Enid, Okla.		
Duluth & Iron Range R. R.....	1	161
B. T. McIvers, Two Harbors, Minn.		
Duluth, Missabe & Northern Railway.....	1	242
W. A. McGonagle, Duluth, Minn.		
Duluth, South Shore & Atlantic Railway.....	1	581
W. M. Noon, Marquette, Mich.		
Elgin, Joliet & Eastern Railway.....	2	221
A. Montzheimer, Joliet, Ill.		
G. F. Powers, Joliet, Ill.		
El Paso & Northeastern Co.....	2	810
Bailey J. Mustain, El Paso, Tex.		
Sam Mustain, Alamogordo, N. M.		
Erie Railroad (and Chicago & Erie).....	4	2,420
W. O. Eggleston, Huntington, Ind.		
Fred A. Knapp, Jersey City, N. J.		
Neil McLean, Huntington, Ind.		
W. H. Wilkinson, Elmira, N. Y.		
Florida East Coast Railway.....	1	628
E. K. Barrett, St. Augustine, Fla.		
Fort Smith & Western Railway.....	1	217
B. F. Beckman, Ft. Smith, Ark.		
Fort Worth & Denver City Railway.....	1	453
J. M. Mann, Fort Worth, Tex.		
Frisco Lines.....	1	6,022
H. M. Henson, Beaumont, Tex.		
Galveston, Harrisburg & San Antonio Railway and Texas & New Orleans Railroad.....	2	1,782
A. J. Ross, El Paso, Tex.		
C. A. Thanheiser, Houston, Tex.		
Gila Valley, Globe & Northern Railway.....	1	125
C. C. Mallard, Globe, Ariz.		

	Members.	Mileage.
Grand Rapids & Indiana Railway.....	1	599
W. S. McKeel, Grand Rapids, Mich.		
Grand Trunk Railway System.....	3	4,642
A. Findley, Montreal, P. Q.		
George A. Mitchell, Toronto, Ont.		
K. J. C. Zinck, Montreal, P. Q.		
Gulf, Colorado & Santa Fé Railway.....	2	1,434
E. C. George, Beaumont, Tex.		
K. S. Hull, Beaumont, Tex.		
Halifax & Southwestern Railway.....	1	369
L. H. Wheaton, Bridgewater, N. S.		
Illinois Central Railroad.....	10	4,431
P. Aagaard, Chicago, Ill.		
C. C. Bean, Freeport, Ill.		
F. O. Draper, Chicago.		
T. J. Fullem, Chicago, Ill.		
R. J. McKee, Carbondale, Ill.		
Samuel P. Munson, Mattoon, Ill.		
William Reed, Jr., Carlinville, Ill.		
C. E. Thomas, Cent. Sta., Chicago, Ill.		
W. C. Waggoner, Princeton, Ky.		
E. F. Wise (retired), Waterloo, Ia.		
Illinois Southern Railway.....	1	135
G. O. Lilly, Sparta, Ill.		
Intercolonial Railway.....	8	1,467
T. C. Burpee, Moncton, N. B.		
John Forbes, Moncton, N. B.		
Hugh Jardine, Moncton, N. B.		
A. E. Killam, Moncton, N. B.		
H. I. McGrath, Moncton, N. B.		
W. B. McKenzie, Moncton, N. B.		
Thomas Sefton, Moncton, N. B.		
A. C. Selig, Moncton, N. B.		
International & Great Northern Railway.....	1	1,159
H. M. Jack, Palestine, Tex.		
Kansas City, Clinton & Springfield Railway...	1	155
J. B. Brown, Clinton, Mo.		
Lake Erie & Western Railway.....	1	719
J. N. Penwell, Tipton, Ind.		

	Members.	Mileage.
Lake Shore & Michigan Southern Railway.....	3	1,529
Willard Beahan, Cleveland, O.		
Phillip O'Neill, Adrian, Mich.		
R. H. Reid, Cleveland, O.		
Lake Superior & Ishpening Ry., Munising Ry., and Marquette & S. E. Ry.....	2	160
August Anderson, Marquette, Mich.		
Roscoe C. Young, Marquette, Mich.		
Lehigh & Hudson River Railway.....	1	96
J. E. Barrett, Warwick, N. Y.		
Lehigh Valley Railroad.....	10	1,434
E. B. Ashby, South Bethlehem, Pa.		
Walter G. Berg, New York City.		
W. E. Harwig, Phillipsburg, N. J.		
R. L. Heflin, Sayre, Pa.		
Peter Hofecker, Sayre, Pa.		
Judson Joslin, Auburn, N. Y.		
David A. Keefe, Athens, Pa.		
F. E. Schall, South Bethlehem, Pa.		
J. Van der Hoek, Buffalo, N. Y.		
E. R. Wenner, Wilkesbarre, Pa.		
Liberty-White Railroad.....	1	51
J. T. Burke, McComb, Miss.		
Louisville & Nashville Railroad.....	3	4,290
R. O. Elliott, Columbia, Tenn.		
Floyd Ingram, Erin, Tenn.		
A. B. McVay, Evansville, Ind.		
Maine Central Railroad.....	2	920
C. S. Osgood, Rumford Falls, Me.		
P. N. Watson, Brunswick, Me.		
Mexican Central Railway.....	1	3,156
Hans Bentele, City of Mexico, Mexico.		
Michigan Central Railroad.....	5	1,770
S. D. Bailey, Detroit, Mich.		
Charles Carr, Jackson, Mich.		
Thomas Hall, St. Thomas, Ont.		
Henry A. Horning, Jackson, Mich.		
J. T. Webster, St. Thomas, Ont.		
Minneapolis & St. Louis Railroad.....	1	999
Ed. Gagnon, Minneapolis, Minn.		

	Members.	Mileage.
Minneapolis, St. Paul & Sault Ste. Marie Rail- way	2	2,301
A. Amos, Minneapolis, Minn.		
P. Swenson, Minneapolis, Minn.		
Miss. River & Bonne Terre Railway.....	1	46
C. H. Fake, Bonne Terre, Mo.		
Missouri, Kansas & Texas Railway.....	2	3,043
F. W. Bailey, Denison, Tex.		
J. G. Gossett, Denison, Tex.		
Missouri Pacific Railway System.....	12	6,472
(Including St. L., I. M. & S.)		
Robert J. Bruce, St. Louis, Mo.		
J. A. Costolo, Carondelet, Mo.		
E. Fisher, St. Louis, Mo.		
F. W. Hausgen, Pacific, Mo.		
U. A. Horn, Osawatomie, Kan.		
T. S. Leake, St. Louis, Mo.		
J. O. Potts, St. Louis, Mo.		
C. A. Sibley, St. Louis, Mo.		
F. B. Scheetz, St. Louis, Mo.		
W. T. Schultz, St. Louis, Mo.		
F. W. Tanner, St. Louis, Mo.		
L. J. Wackerle, St. Louis, Mo.		
Mobile & Ohio Railroad.....	2	926
S. Cheatham, Okolona, Miss.		
E. P. Hawkins, Murphysboro, Ill.		
Nashville, Chattanooga & St. Louis Railway..	1	1,212
I. O. Walker, Paducah, Ky.		
New Orleans Terminal Co.....	1	23
Frank G. Jonah, New Orleans, La.		
New South Wales Government Railways.....	1	3,138
James Fraser, Sydney, N. S. W.		
New York Central & Hudson River Railroad..	9	2,829
William Kleefeld, Jr., Watertown, N. Y.		
G. J. Klumpp, Rochester, N. Y.		
J. F. Lantry, Weehawken, N. J.		
R. P. Mills, Mott Haven, N. Y.		
Kamper Peabody, Mott Haven, N. Y. City.		
W. A. Pettis, Rochester, N. Y.		
Edward Rykenboer, Rochester, N. Y.		
H. C. Thompson, Weehawken, N. J.		
E. E. Wilson, Mott Haven, N. Y. City.		

	Members.	Mileage.
New York, Chicago & St. Louis Railroad.....	1	523
James Rogers, Fort Wayne, Ind.		
New York, New Haven & Hartford Railroad...	10	2,057
Grosvenor Aldrich, Readville, Mass.		
J. S. Browne, Providence, R. I.		
Wm. H. Moore, New Haven, Conn.		
H. W. Phillips, South Braintree, Mass.		
L. H. Porter, Franklin, Mass.		
George A. Rodman, Providence, R. I.		
George T. Sampson, Boston, Mass.		
W. B. Schuessler, New Haven, Conn.		
D. W. Sharpe, New London, Conn.		
J. B. Sheldon, Providence, R. I.		
New Zealand Government Railways.....	2	2,291
C. H. Biss, Auckland, New Zealand.		
George A. Troup, Wellington, New Zealand.		
Norfolk & Southern Railway.....	1	473
Thomas W. Cothran, Raleigh, N. C.		
Northern Pacific Railway.....	7	5,437
F. R. Bartles, Fargo, N. D.		
James Hartley, Staples, Minn.		
N. F. Helmers, Minneapolis, Minn.		
F. Ingalls, Jamestown, N. D.		
C. S. McCully, Jamestown, N. D.		
R. E. McFarlane, Duluth, Minn.		
J. C. Taylor, Glendive, Mont.		
Oregon Short Line Railroad.....	1	1,396
A. H. King, Salt Lake City, Utah.		
Pennsylvania Lines West of Pittsburg.....	5	2,717
S. Geary, Cambridge, O.		
C. M. Large, Jamestown, Pa.		
A. F. Miller, Chicago, Ill.		
D. G. Musser, Wellsville, O.		
D. C. Zook, Fort Wayne, Ind.		
Pennsylvania Railroad.....	4	5,190
J. A. Blair, Pittsburg, Pa.		
H. R. Leonard, Philadelphia, Pa.		
Robert McKibbin, Pittsburg, Pa.		
C. W. Richey, Pittsburg, Pa.		

	Members.	Mileage.
Pere Marquette Railroad.....	2	2,398
G. E. Hanks, Saginaw, Mich.		
A. McNab, Holland, Mich.		
Philadelphia & Reading Railway.....	3	1,477
John Foreman (retired), Pottstown, Pa.		
W. W. Perry, Williamsport, Pa.		
E. G. Storck, Philadelphia, Pa.		
Pittsburg & Lake Erie Railroad.....	2	191
D. L. McKee, McKee's Rocks, Pa.		
G. H. Soles, Pittsburg, Pa.		
Rutland Railroad	1	416
J. E. Johnson, Rutland, Vt.		
St. Joseph & Grand Island Railway.....	1	313
O. H. Andrews, St. Joseph, Mo.		
St. Louis, Iron Mountain & Southern (see Missouri Pacific System).		
St. Louis Southwestern Railway.....	1	1,451
J. S. Berry, Tyler, Tex.		
South & Western Railway.....	1	177
William F. Steffens, Johnson City, Tenn.		
Southern Railway.....	5	7,282
James T. Carpenter, Princeton, Ind.		
J. S. Lemond, Charlotte, N. C.		
D. W. Lum, Washington, D. C.		
J. W. Morgan, Columbia, S. C.		
G. W. Welker, Alexandria, Va.		
Southern Pacific Company.....	10	5,971
T. W. Bratten, West Oakland, Cal.		
Frank V. Carman, West Oakland, Cal.		
R. M. Drake, San Francisco, Cal.		
F. W. Lloyd, Oakland Pier, Cal.		
W. J. Mellor, Algiers, La.		
P. N. Nelson, San Francisco, Cal.		
H. Pollard, San Francisco, Cal.		
George W. Rear, San Francisco, Cal.		
Daniel Robertson, West Oakland, Cal.		
L. D. Smith, Oakland Cal.		

	Members.	Mileage.
Texas & Pacific Railway.....	1	1,848
E. Loughery, Marshall, Tex.		
Texas Midland Railroad.....	1	125
E. H. R. Green, Terrell, Tex.		
Toledo, Peoria & Western Railway.....	1	248
J. H. Markley, Peoria, Ill.		
Union Pacific Railroad.....	4	3,033
J. C. Beye, Kansas City, Mo.		
J. H. Howe, Omaha, Neb.		
J. L. Neff, Omaha, Neb.		
J. Parks, Denver, Col.		
Vandalia Railroad	1	821
J. L. McKee, Spencer, Ind.		
Virginian Railway.....	1	446
John I. Banks, Norfolk, Va.		
Wabash Railroad	3	2,517
A. C. Blake, Moberly, Mo.		
A. O. Cunningham, St. Louis, Mo.		
William S. Danes, Peru, Ind.		
Wellington & Manawata Railway (New Zealand)	1	84
Arthur Williams, Wellington, New Zealand.		
Western Australia Government Railways.....	2	1,516
W. J. George, Perth, Western Australia.		
E. S. Hume, Fremantle, Western Australia.		
Wisconsin Central Railway.....	1	1,022
Henry Bender, Fond du Lac, Wis.		
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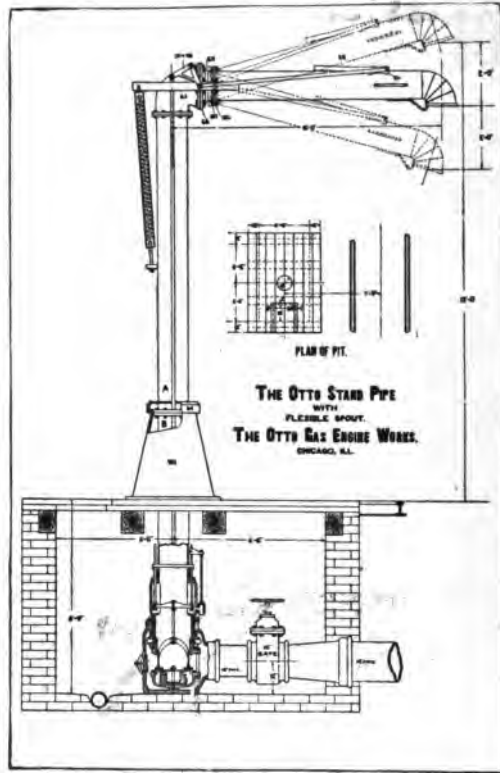
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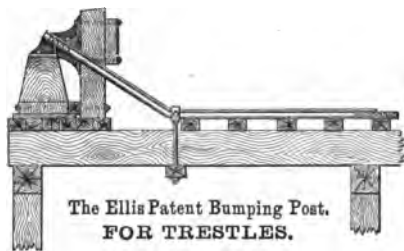
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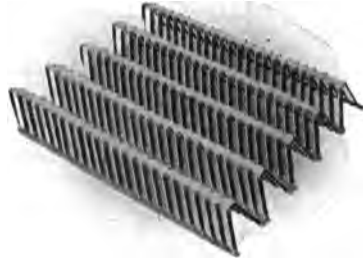
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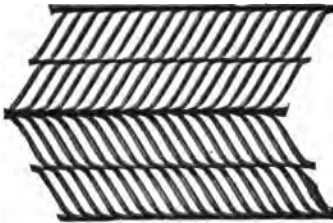
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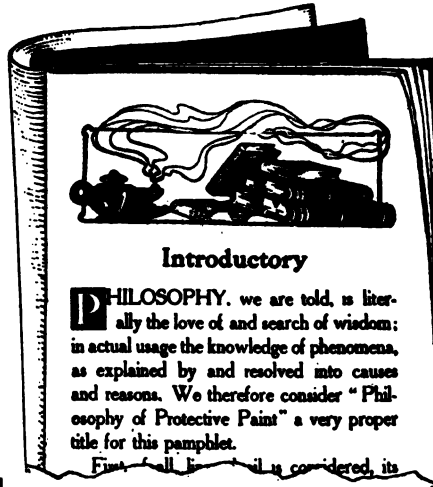
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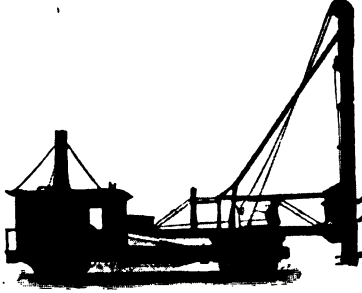
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